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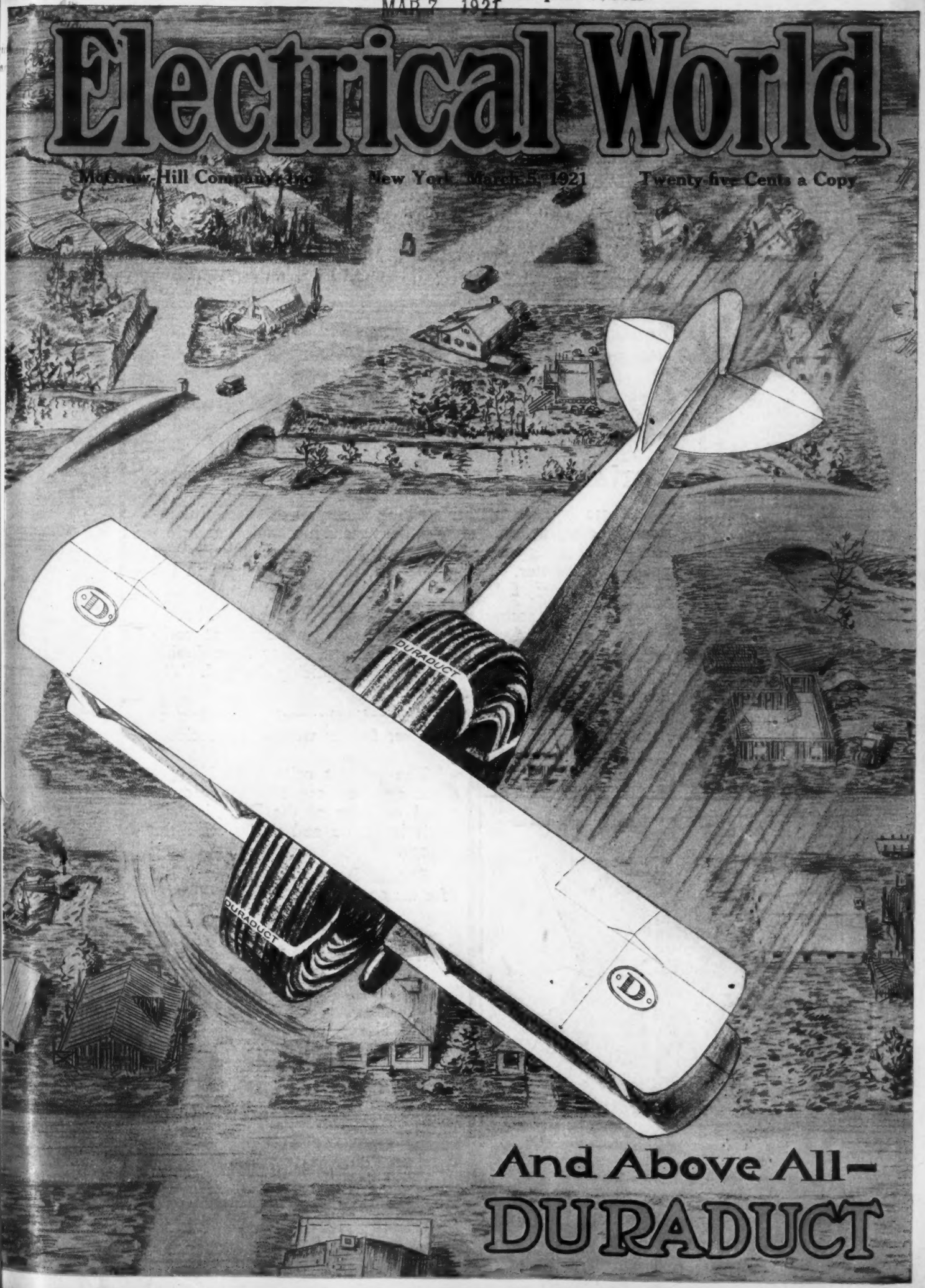

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Herbert Hoover's New Sphere of Service

NO CABINET appointment for very many years has been greeted with such an outburst of popular approval as met the announcement that Herbert Hoover would be numbered among President Harding's official advisers. This approval came from all political parties, all classes of citizens and all geographic sections of the nation. To engineers it is especially gratifying that one of their leaders should be so recognized; but, quite apart from this, engineers can join with other Americans in applauding the selection of a man with the great administrative ability, the boundless energy, the broad and fearless outlook and the practical humanity of him who fed Belgium during her invasion and has mitigated the horrors of after-war famine in half a score of European countries. Mr. Hoover, the President has announced, is to have a free hand in his department. Hitherto the Secretaryship of Commerce has ranked as one of the least of Cabinet portfolios. It is a safe prediction that when Mr. Hoover shall surrender it it will rank among the greatest.

Expansion of the Society for Electrical Development

GOOD news comes from the Society for Electrical Development. Announcement is made that William L. Goodwin has joined its staff. From now on the excellent work which the society has done will, by the injection of so picturesque and strong a personality as Mr. Goodwin's, be materially expanded and enhanced. Such a union of able and co-operative forces must logically lead to more extensive work, and this in turn will justify greater recognition and support from the industry. That support the Society for Electrical Development has always been entitled to and now must have in larger measure, if the electrical idea is to be pushed vigorously and if co-operation within the industry itself is to be more than empty adulation. Messrs. Wakeman and Goodwin, however admirably fitted for the task each may be, cannot of themselves and unsupported exert any lasting influence on the course of events in the industry. The mere consolidation of co-operative forces does not superinduce accomplishment or excuse the manufacturer, jobber, contractor and public utility operator from performing the duty which each owes to the others and to the public of rendering such service within their respective spheres and powers as may tend to make more happy and contented the lives and lot of their fellow men. But the leaven must work from below, not from above. Co-operation nationally is unthinkable without co-operation locally, and fruitful soil awaits tilling in many localities. By establishing electrical leagues in all of the large cities of the country the Society for Electrical Development can render meritorious service to the industry and add new luster to its laurels. For this task Mr. Goodwin's experience and aptitude are admirably suited. He has toured the country on exactly such work and now will have the services of an established organization to follow it up, an advantage heretofore lacking. The opportunities indeed are numerous, and with Mr. Goodwin's help the S. E. D. should have no difficulty in making the most of them. The union of co-operative forces is certainly a happy one, and the results accruing from it are sure to be telling. We shall watch with interest the developments which are bound to follow.

Light Up and Be Seen

ABRAHAM LINCOLN believed no duty was more constant than to keep accessible to the people. Accessibility is essential to any one engaged in public affairs, and no one is more closely connected with public affairs than a public utility operator. To be widely and favorably known is an asset. This is true not only of individuals but also of companies and industries. At this time, when the National Electric Light Association is engaged in a nation-wide campaign of good will, every effort should be put forth to make the campaign effective by focusing the attention of the public on the electric light and power business. This is a work worthy the zeal of every manager. Not only should the advertisements of the association and of the electrical manufacturers be printed locally, but the story should be told by word of mouth to every one in the community. It is futile, however, to talk about something that people know little about and to try to interest them in investments they have rarely seen. To accentuate the campaign the officers and power stations of electric light companies should be the brightest spots in the community. There is nothing more attractive than light. It causes surprising transformations. It begets good cheer and confidence. Therefore, as the apostle of light, every electric utility should use it freely. If we are to get some benefit out of the good-will campaign, let's all light up and be seen.

The Daylight-Saving Muddle

IT LOOKS very much as if in the coming season we were to have another sample of the confusion thrice confounded that afflicted the clocks of the Northeastern States last year. Massachusetts, New York and New Jersey are struggling with the situation, which is being severely let alone by most of the other states. Now, from a personal standpoint we like daylight saving well enough. We do not think that central station companies as a whole are particularly interested in the matter just now, and the whole problem seems to have resolved itself into a struggle between the dwellers in the large

cities and their immediate suburbs and the population of the United States at large. Such questions are bound to arise when, as here, an abnormally large portion of the population is urban; but why this particular matter should cause so much disturbance when the remedy is simple and easy it is a little hard to see. Granted that there is an irreconcilable difference of opinion between the country community and the city industrial community, why should not the former stick to standard time if it so prefer and the latter adjust its habits to the hours suitable for daylight saving without attempting to thrust its preference down the throat of any one else?

There would be one great practical advantage in this suggestion because those who deem it wise to keep early hours in the summer probably would not all keep the same hours, which would have a beneficial effect on the urban transportation situation. We should be entirely cheerful if daylight saving were accepted or rejected by the people at large, but the whole proposition reached a *reductio ad absurdum* last season when in certain summer colonies the conservative natives held to Eastern standard time and the seasonal visitors stuck to daylight saving. The "up-state" proposition of local option in New York would lead to a somewhat similar result.

Production Economies in Industrial Plants

SURPRISING results have been shown by those industrial electrical engineers who have given careful study to plant production. Through the use of graphic charts it has often been possible to visualize the entire range of production methods. Such checks are infallible evidence of what has actually been accomplished by a machine, department or industry. That is, in a plant using electric power to any extent whatever energy consumption bears a very definite relation to the output. In some cases this may not be entirely true as relates to the finished product, but it is true for the unit processes. The method makes it possible to study operations in various sections of the plant or unit machines and to proceed almost automatically and at very little expense. For instance, when one well-known mining company had difficulty in obtaining accurate records of production for electric shovels, a recording instrument placed on the supply lines of particular installations made it possible to check records at the substation several miles distant. The efficiency of the working units was improved quite remarkably.

In the interest of self-advancement, if for no other reason, the men in charge of the electrical department of an industrial plant should be wide awake to the possibilities of such studies. Where it is difficult to open the eyes of the management to the necessity for work of this kind or the benefit to be derived by the investigations, even a start may produce evidences which will be helpful in justifying more elaborate installations of recording apparatus and facilities for analyzing the records.

For this preliminary work an elaborate outlay of instruments is unnecessary, for it is possible to make interesting studies with such indicating instruments as usually are at hand. Instruments of this kind do not give so much detailed information as graphic meters, but they may be the means of obtaining a more complete outfit at a later date. Frequent readings of substation indicating instruments where no recording instruments have been installed will also offer interesting possibilities. This opens an interesting field for the industrial electrical engineer, a field full of possibilities for economies by which he can demonstrate in a practical way the growing need for an adequate electrical division in the organization of the industrial-plant production department.

The Dangers that Lurk in Complacency

COMPLACENCY might be defined as the state of mind induced when one is well pleased with himself. On another page S. M. Kennedy, vice-president of the Southern California Edison Company, dwells in his characteristic manner on the dangers of the complacent state of mind in officials and underlings of public utilities. War conditions tended to foster extreme independence and something approaching patronage on the part of all dealers in commodities for which the demand exceeded the supply, and this attitude in turn aroused resentment and hostility on the part of customers and would-be customers—both dealers and customers thus proving themselves entirely human. Always a mistake, under present conditions the complacent attitude should not be tolerated for a minute where public relations are concerned, and where it may still linger in the precincts of electric light and power companies a perusal of Mr. Kennedy's article should arouse executives to the task of rooting it out and keeping it out.

Power Development of the Future

A FEW years ago dependable data showed that many hydraulic plants could not successfully compete with first-class efficient steam plants in the production of power. To an extent even now the balance in cost is rather a nice one, but there are many hydraulic developments which will pay at present and probable future prices of fuel which would not have done so ten years ago. In general the outlook for hydro-electric development is rather better than worse. Aside from this, there is the imperative necessity of keeping the cost of fuel from mounting out of sight by such measures of conservation as can be taken, and this again calls for more water power. But water power alone cannot be utilized efficiently in most topographical situations. To make the most of the total run-off either enormous storage must be present or developed or auxiliary power must be provided so that something like full utilization of all the available water can be obtained, which is quite impossible at the present time with even a moderately steady demand. The situation therefore calls for the combination of steam and water generating plants, so that the cheaper power can be fully utilized without failing to meet the supply at times of maximum demand.

Superpower plants situated suitably with respect both to fuel and water supply are a logical necessity. However, the importance of water supply is not always fully recognized, because it is perfectly easy to conceive a condition where the whole volume of a considerable stream would have to be utilized for condensation. This necessity limits the available situations for the great plants of the future. Ofttimes the mouth of the mine is the spot preferred for such plants, but generally they

cannot be erected there for lack of water. The problem then to be faced is finding the situations that will give the best balance in both requirements.

It must not be forgotten that with proper transportation facilities energy as coal can be very cheaply transmitted. Roughly, one can say that a ton of coal represents 1,000 kw.-hr., and it is a perfectly easy matter to lose in electrical transmission enough energy more than to cover the cost of judicious and well-planned transportation. The real importance of the so-called mouth-of-the-mine plant lies in its ability to utilize fuels not suitable for transportation in any other way than over a wire. As a rule the steam-driven superpower plant involves both kinds of transportation, for it will be located with reference more to its general usefulness and its possibility of water supply than to absolute propinquity to the coal mines. It is not unreasonable, therefore, to expect the very great stations of the future to keep up the use of transported fuel in order that they may more efficiently generate and distribute electrical energy.

The financial strain imposed by an attempt at present to create great superpower distributing systems is so serious that we do not look forward to immediate action in the broader aspects of the situation. What is far more likely to occur is the growth of such systems by concerted action among great enterprises now active, exchange of power over long distances, strengthening the common supply by gathering energy from hydroelectric sources, completing and interlocking the distributing networks that are subsidiary to the transmissions proper. Splendid as the big projects which of late have been suggested are, they must face the financial conditions which inhere in the situation as it is, and we are half inclined to believe that the superpower system will come upon us sooner than we think, but in a form which we shall only gradually come to recognize as the accomplished fact.

Equations for Long Transmission Lines

IN THE extension of the field of any art the attack of new problems usually means the introduction of new factors hitherto absent or negligible in the application of underlying physical principles. A particularly striking instance in the electrical field is the extension of the distance of power transmission. In the early days of continuous currents Ohm's law sufficed. With the introduction of alternating currents line reactance appeared, and for many problems today it is the only important additional factor. With long high-voltage lines, however, line capacity appears, and we have in our calculations in addition to time the new variable of distance to reckon with.

The differential equations for a long line are very simple in form, but their solutions involve exponential or the equivalent hyperbolic functions of the line constants and of the distance. Unfortunately, relatively few engineers are expert in the handling of these functions. As a result we have had from time to time a number of proposed approximate methods which avoid the difficulty mentioned.

A noteworthy example of one method was presented in a paper by A. McKinstry before the British Institution of Electrical Engineers. The paper analyzes with thoroughness the equations for a 90-mile (145-km.) line and a 380-mile (610-km.) line, computing all of the important numerical values. Of particular interest is the deduction of the equation of the circle diagram of the power and reactive components of the load current, and from it the values of synchronous capacity necessary for controlling regulation and improving line efficiency.

It should be remembered, however, that much of the early objection to the use of the rigorous method of solution lay in the absence of complete tables of hyperbolic functions and the tedium of evaluating exponential forms. The former difficulty has been removed now by the excellent tables of Kennelly and others, and there is no longer any necessity for approximations of the type mentioned. There is no reason why an engineer should not use the hyperbolic and trigonometric functions with equal facility.

Epoch-Making Contribution on Multiple-Harmonic Communication

THE paper on "Carrier-Current Telephony and Telegraphy" read by Messrs. Colpitts and Blackwell at the midwinter convention of the American Institute of Electrical Engineers is an epoch-making contribution to the literature of multiple-harmonic telegraphy and telephony. It illustrates throughout the enormous practical importance of the principle of resonant selection in electric circuits. If a line circuit can be tuned sharply to a particular frequency, then, no matter how many frequencies are impressed simultaneously upon the line, the resonant circuit will respond promptly and selectively to signals of that one frequency. The paper might aptly be described as the application of vacuum tubes to multiple telephony and telegraphy.

A most important device described is the alternating-current filter. Three types are emphasized, namely, high-pass, low-pass and band-pass filters. The sharpness of cut-off in these filters is remarkable and indicates the result of much research work.

In addition to the remarkable achievements already attained by the American Telephone & Telegraph Company in multiple-communication circuits, as described in the paper, it is suggested that a very workable assignment of frequencies over a single two-wire line would be eight telephonic one-way bands, each 3,000 cycles per second wide, and sixteen one-way telegraphic bands, making a total of twenty-four channels without exceeding the frequency of 30,000 cycles per second. Thus one pair of wires may serve to carry on four telephone conversations and also the equivalent of eight duplex telegraph connections.

It is evident that in any such partition of frequencies the telephone is much more exacting than the telegraph. A telephone band occupies a range of 3,000 cycles per second. A telegraph band may occupy a range of only 200 cycles per second. Thus telephony comes wide, but we must have it. It is also evident that such a system of multiple communication finds its best field of usefulness in densely populated districts where wires are relatively scarce, special apparatus is available and trained inspection is forthcoming. Two wires as a metallic circuit can then be made to do the work of twenty, but the line construction must be of the first class, the wires must be balanced, and properly transposed, and intelligent care must be devoted to the entire system. In these directions we may look for the future development of multiple telephone and telegraph lines.

Lewis Buckley Stillwell

Whose recommendations led to the adoption of 60 cycles as the standard frequency in the United States, and to whom belongs much of the credit for making alternating current a commercial success in the early days

ALTHOUGH the genius makes the discovery of the fundamental principle, it frequently remains for the clear-headed, practical thinker to make the conception a commercial success. Because of his engineering vision in the early days of electric service, to L. B. Stillwell belongs the credit for removing many of the troubles that impeded the progress of the use of alternating current. Back in 1887 the Westinghouse company installed at New Orleans what was a record-size alternating-current lighting plant, but the feeders were carried on the same poles, and when the current was turned on it was found that the light intensity fluctuated so greatly that the service was useless. It looked as though alternating current was a failure until young Stillwell, but a year out of college, was sent to New Orleans. In less than two days he had by shifting the circuits eliminated the trouble. This was the first time that mutual inductance had been encountered commercially. It was not surprising then to find him working on this problem of induction, his labors resulting later in the issue of patents to him for a booster to regulate and control feeder circuit voltage, now commonly known as an induction regulator.

Upon his return from a visit to Europe in 1890 Mr. Stillwell was appointed chairman of the Westinghouse committee to select for that company a standard frequency. As a result 30 cycles and 60 cycles were chosen, and the latter has since become the standard for this country. Soon after this Mr. Stillwell was asked to direct the technical development of the plans for the first Niagara installation, which secured for Westinghouse the initial contract for three 5,000-hp. alternators. Subsequently, in 1897, he became electrical director of the Niagara Falls Power Company and the Cataract Construction Company, remaining until 1900, when the first 50,000-hp. plant at Niagara Falls had been completed. Other important contributions to the art by Mr. Stillwell are the time-limit circuit breaker and switchboard control for remote operation.

Born in Scranton in 1863, he was educated at Wesleyan and Lehigh, where he completed in 1885 a course in electrical engineering, taking mechanical engineering the following year. From 1886 until 1890 he was assistant electrician for the Westinghouse interests, and for the next seven years he was chief electrical engineer. In 1900 he went to New York to engage in consulting engineering, having been for the year previous retained in that capacity by the Manhattan Railway Company. That year he became electrical director for the New York City subway and elevated traction systems and later consulting engineer in charge of electrical equipment for the four Hudson River tunnels.

Mr. Stillwell's work has been of that high order which brings recognition from the engineering profession. He is a past-president of the American Institute of Electrical Engineers and of the American Institute of Consulting Engineers and was one of the two engineers elected to the board of the Chamber of Commerce of the United States when for the first time the engineering profession received such recognition from that body.

Feasibility of Hydro-Electric Power for New York Metropolitan District*

Resources at Niagara, in St. Lawrence and Delaware Rivers and in the Adirondacks Region — Difference in Frequencies Present Obstacles — Interruptions to Service Cannot Be Tolerated — Disadvantages of Long-Distance Transmission Considered

By COL. WILLIAM BARCLAY PARSONS
Consulting Engineer, New York City

THE growth of electric central power stations of late is indicative of what is to be expected in the extension of the application of power. This development is reflected in the central-station power statistics of New York. In the state, exclusive of New York City, there was installed in central power stations and electric railway stations in 1910 approximately 550,000 hp., while in 1919 there was 1,150,000 hp. In the metropolitan district—that is, New York and the adjacent territory in New Jersey, which it is convenient to treat as a whole—the installation on the same dates amounted to 920,000 hp. and 2,100,000 hp. respectively, giving totals for the state, including the metropolitan district, of 1,070,000 hp. in 1910 and 3,250,000 hp. in 1919. From these figures it will be seen that the increase in installed capacity has been at the rate of more than 120 per cent in nine years for the metropolitan district and only slightly less for the remainder of the state. In order to be conservative, the probable installed capacity in 1930 has been placed at 6,700,000 hp., of which 4,500,000 hp. will be in the metropolitan district and 2,200,000 hp. "up state," an increase of about 100 per cent.

Translating these figures into dollars and estimating the cost of installing a steam-producing horsepower at $100 and a water-producing horsepower at $200 including transmission, there will be required during the next ten years in the state new capital for central station and transmission lines, exclusive of the cost of appliances for utilization, to the amount of $350,000,000 and $700,000,000 respectively. These estimates agree fairly well with those recently given in an electrical paper† to the effect that during the next four years there should be similarly expended in the United States a sum of money between $2,000,000,000 and $4,000,000,000. Such figures are appalling, but they must be faced and met or the electrical development of this country will suffer.

The same consideration—namely, the cost of production—that is driving individual producers of power to central stations is now forcing central stations to consider in what way their rising expenses can be kept within reasonable bounds. In this connection it is of the highest interest to note that one of the few items that have not been substantially raised in cost during the last few years is the selling charge for electrical energy. Although coal, which accounts for 75 per cent of the cost of producing energy, has more than doubled in cost and labor nearly doubled, so that the operation cost of generating electric energy in economically run central stations has risen from less than ½ cent per kilowatt-hour to nearly 1 cent per kilowatt-hour (exclusive of the cost of distribution and of interest, taxes and all overhead charges) the selling prices have risen but little. The proportion in rise in selling charges to the total rise in items of expense has been negligible, but it is manifest that such a condition cannot continue.

Unless some radical method can be devised to keep down the ascending rate of cost, higher charges must follow. It is no longer a question of furnishing power at a lower cost, but one of keeping the latter from becoming larger. Unless this question can be solved for the metropolitan district, industries will be driven away to cheaper sources of power.

To avoid the dilemma of higher prices or lack of fair returns on investments, recourse must obviously be made to some other method of producing central-station energy. One alternative is water power. Fortunately, New York State is particularly well favored in this regard, its potential resources exceeding all except three of the Pacific States. These resources lie:

1. In the difference in elevation of 327 ft. between Lake Erie and Lake Ontario, the greater portion of which difference is to be found within a short distance covering the Falls of Niagara with its upper and lower rapids. The Niagara River has a substantially constant flow which, fully utilized, would generate about 5,000,000 continuous horsepower.

2. In the St. Lawrence River, where it is estimated that between 500,000 and 600,000 continuous horsepower can be developed along the New York boundary; or, taking the whole river‡ between Lake Ontario and Montreal, perhaps 5,000,000 hp. can be obtained. Of the Niagara power half would belong to Canada, and of the St. Lawrence power such an amount as would be fixed by international negotiations, though, of course, the maximum that New York could receive would not exceed one-half.

3. In the Delaware River, which, fully developed with storage reservoirs and power plants utilizing the full head, could produce 350,000 hp. Here, however, the rights of three states are involved, although most of the storage reservoirs would be located in New York. Perhaps New York, including the metropolitan district, might secure for its own use 200,000 hp., although the reports of the State Conservation Commissioner claim only 40,000 hp. as being capable of development within the boundaries of the state.

4. In streams lying wholly within the state. By far the greatest portion of such power would come from the streams that rise in the Adirondack region, of which the largest are the Hudson, the Black and the Raquette.

*Discussed before American Society of Civil Engineers.
†See ELECTRICAL WORLD, Jan. 1, 1921.

‡See page 312, Feb. 5, 1921, ELECTRICAL WORLD.

The State Conservation Commissioner has estimated that the interstate streams have a potential undeveloped power amounting to more than 1,000,000 hp. The independent investigation that has been in progress for more than a year seems to confirm this estimate, provided the streams are developed as a whole. It is only by complete development that the expense incident to the making of large storage reservoirs capable of fully regulating the flow in all but very wet years can be economically justified. If development be left to uncoordinated individual efforts, nothing like the above total amount of power can be had.

The total amount of hydro-electric power that can be obtained in New York, provided Niagara be fully utilized and that one-half the St. Lawrence power contiguous to New York State be considered, will not exceed 4,500,000 hp. But public opinion will not permit the full utilization of Niagara, at any rate not until the demand for new sources of power is more imperative than it is at present. Complete development of the St. Lawrence is also likely to be postponed for many years, so that New York's actual undeveloped sources in sight can be put as not exceeding 1,500,000 hp. It has been shown above, with a very conservative estimate for additional power installation, that before the end of the present decade there will be needed about 3,500,000 hp. It is, therefore, obvious that much of the power installation that can be expected in the near future will be of the steam-electric type, with the attendant high cost of operation.

Unless some radical changes are made, it will be impossible to serve all stations from the same transmission lines without wasteful frequency changes. Leaving out of consideration a few odd frequencies which are local in character and negligible in amount, it is found that the installations in New York State are divided as follows:

Frequency	Horsepower Installed
60-cycle	700,000
40-cycle	150,000
25-cycle	1,950,000

Unfortunately these variations in frequency are scattered throughout the state, although the frequency at which the Niagara current is generated (25 cycles) is the same frequency at which the greater part of the energy in New York City is generated, the figures in New York City being:

Frequency	Horsepower Installed
60-cycle	280,000
25-cycle	1,450,000

The 40-cycle frequency is found as a general thing in the territory adjacent to and extending from Albany westerly as far as Utica, but in this same territory there is to be found side by side with the 40-cycle a large amount of 60-cycle energy. A study of growth seems to show that 60-cycle power is increasing at a much higher ratio than either of the others and that there is a tendency on the part of 40 cycles to give way to 60. It is likely that within a comparatively short time 40 cycles will be eliminated and the state development will be confined to the two frequencies of 60 and 25. In New York City all the power generated at 25 cycles is converted to direct current for utilization. In the present state of the art there seems to be no reason why all this current could not be generated at 60 cycles as well as at 25, except for the fact that the present equipment is arranged for conversion from 25-cycle alternating current to direct current.

In that portion of New Jersey included within the metropolitan area the situation is different. Here the 60-cycle predominates, the installation being:

Frequency	Horsepower Installed
60-cycle	250,000
25-cycle	60,000

It is on the metropolitan district that the burden of furnishing new installation will fall. Of the estimated 6,700,000 hp. of installation that should be in existence in 1931 to meet the expected demand, 4,500,000 hp. will be found within a distance of 30 miles from New York.

The metropolitan district is not only the largest aggregation of population in the United States, but it is also the largest center of manufacturing. Here will be found one-twelfth in value of the total manufactured production of the country—an amount greater than that of the whole State of Pennsylvania. In this area demands for service are so much more exacting than in any other part of the state that any interruption of service cannot be tolerated. Service in New York City must be continuous. To this end the distributing companies have assumed the burden of great capital investment in placing all their transmission wires in underground conduits where they are as free from outside interruptions as it is possible for human ingenuity to devise. Duplicate lines, several generating stations and a great reserve of power guarantee continuity of service. Besides continuity, there must also be a readiness to meet sudden and unexpected demands.

In the metropolitan district, particularly the lower part of Manhattan Island, the normal times of peaks vary somewhat with the season; but, unlike conditions in other districts, an excessive peak may occur at any time and at any hour owing to sudden darkening of the skies. This requires the maintenance of stand-by plants that can be brought to full capacity on advance notice that may be limited in time by minutes only. These items so swell the expense of distribution that the cost of producing power represents a much smaller percentage of the whole than in plants located elsewhere. Hydro-electric power is less advantageous to the metropolitan district not only because in New York items other than production cost make such a great proportion of the total cost of delivering energy, but also because the source of hydro power is far removed. Being thus removed and not under direct control, it might not be available in time for an emergency peak.

Hydro-electric transmission lines to the metropolitan district, varying in length from 100 miles, as would be the case with energy from the Delaware River, to 250 miles from the Adirondacks and more than 350 miles from the St. Lawrence and Niagara, present to a manager in the metropolitan district worries as well as advantages. But duplicate lines, and especially lines coming from different directions, the most substantial type of aërial construction that the state of the art will provide, and main trunks with few if any branch connections between points of origin and delivery, will undoubtedly eliminate some of the fears and permit the bringing to New York of hydro-electric power to take a part of the 4,500,000 hp. that must be in operation in this district before 1930. Storage reservoirs, whence

can be drawn not only the regular supply but also a temporary excess, would furnish valuable insurance against a failure in coal delivery and present an additional and highly attractive feature. This insurance would offset many of the disadvantages inherent in long-distance transmission. Storage of fuel in New York, where the consumption is measured by thousands of tons a day, is possible for a few weeks only. On more than one occasion this city has been dangerously close to a point of actual shutdown due to this failure in delivery. Power thus drawn from storage reservoirs in times of such emergency could be restored by operating the steam plants over longer periods when fuel is available.

Great as are the potential resources of New York in water power, two things are obvious: (1) That in amount they are not in excess of actual requirements; (2) that the objections to long-distance transmission lines will prevent the bringing of the whole of the supply of the metropolitan district from northern points. The cost of fuel, which, although it may fluctuate up and down, nevertheless is bound over a course of years to keep on increasing, raises the question whether the time is not near when some other means of producing power should be resorted to than by bringing coal in bulk to New York and converting it here into energy. The average freight on coal to New York is now about $3.50 per ton. No matter what may happen to the price of coal at the mine, the cost of transporting coal is not likely to be reduced. If hydro-electric power cannot be obtained in sufficient quantities to carry the burden of the demand for additional power, it is only fair to ask whether the high cost of transportation cannot be reduced. It would seem worthy of serious study to compare the transmission of energy generated from coal at the pit mouth with generation of energy at the center of demand.

This is not intended as a suggestion for the burning of waste coal in existing refuse piles. There seems to be no evidence that such piles contain sufficient coal fit for burning to be a factor in supplying power for New York. If power is to be generated at the mines, recourse must be had to taking the whole of the output of certain mines, converting it into energy in large stations and then transmitting the energy thus produced.

A second solution is a more radical one, but it is one that is not impossible and is already engaging the attention of those who are competent to deal with it. This is the storing of energy in such shape as to be transportable in the way coal is transported. If this could be done, the excess and storm flow of streams could be utilized in manufacturing the chemical product, and the great sources of hydro-electric power in the tropics, which now have no market, and where it is hard to see how in the future there can be any market, would become available for producing power for the world at large.

In addition to the direct benefit in lower production cost resulting from hydro-electric development of 1,500,000 continuous horsepower, there is also the great indirect benefit due to the saving of coal. This amount of power, if generated in economical central stations, would require over 10,000,000 tons per annum, while if it should be generated in isolated plants and locomotives on railways, the coal required would be from 40,000,000 to 50,000,000 tons per annum. This saving would tend to preserve our rapidly diminishing coal supply.

Status of Foreign Railroad Electrification

Situation in Suspense Awaiting Decision as to Form of Current to Use—Conditions in Germany, Austria, Sweden, Norway, Holland, Switzerland and Italy

BY E. C. ZEHME
Privatdozent at the Technische Hochschule, Berlin

THE electrification of railroads in Germany, Austria, Sweden, Norway, Holland, Switzerland and Italy is at present somewhat in suspense on account of the lack of a definite decision upon the form of current to be used. Only Switzerland and Austria are at present enlarging their existing single-phase lines. All the other countries, formerly inclined toward the single-phase system, are again in a state of doubt, especially since hearing about the successful operation of American direct-current roads.

PRESENT GERMAN ELECTRIFICATION CONFINED TO TWO LINES

For the time being the electrification of main roads in Germany has been confined to the two main lines, Magdeburg-Halle-Leipzig and Lauban-Königszelt. These two lines suffered badly during the war, being electrically operated only in part, as all the overhead copper wire had to be removed. The copper wire is being now replaced, and some steel wire is being experimentally installed. The installation of the roads in the Silesian mountains has been finished as far as Hirschberg. In the coming spring Lauban, it is expected, will be reached. The necessary funds have been granted for the electrification of the lines east to Breslau and west to Görlitz. The line from Magdeburg to Leipzig is expected to be operated electrically again in two or three months. The electrification of the Berlin rapid transit lines has just been begun, use being made of single-phase current.

No further electrifications are at present in progress. It is obvious that the war caused many of the delays. But the main reason was an unsuitable executive in the railroad ministry, who, with his peculiar ideas, caused a great deal of retardation. Since his resignation some new doubts as to the wisdom of selecting the single-phase system for all German lines are being heard. These doubts were caused by trouble experienced on the Silesian mountain road, which operates on the single-phase alternating-current system. An induced voltage of 4,000 was here discovered in the signal cables lying parallel to the road for 80 km., this induced voltage rapidly destroying the cables. The locomotives, which have an alternating-current commutator motor installed in the upper part of the engine, with rod drive, are at present in repair 85 per cent of the time. The authorities adhere, however, to the alternating-current system, and expect to invite an international congress to Germany in 1921 in the hope of justifying it. It is not expected that the delegates from Switzerland, Austria and Sweden will dare to say officially anything against the alternating-current system chosen by their own lands, and even in America might be found some advocate of that system who might be invited! Altogether, there are today operated electrically 1,514 km. of track in the German Republic, which was built by German concerns.

The Austrian Republic is pushing very energetically

the complete electrification of all of its main roads. A new law has been introduced and passed authorizing and directing the immediate start of the electrification of the following roads: (1) Arlbergbahn, Vorarlbergbahn and all branch lines; (2) Salzkammerguthbahn; (3) Westbahn; (4) Tauernbahn.

The total length of these lines together with the planned additions is 1,788 km., or 40 per cent of all the Austrian railways. These roads are to be operated, if possible, not later than the middle of 1925. The electrification is considered absolutely imperative due to the fact that the post-war Austria has only 16 per cent of the total coal requirements and that electrification will save about 50 per cent of the needed fuel.

Influenced by the German example, the Austrian railway ministry has adopted the single-phase system with $16\frac{2}{3}$ cycles and 15,000-volt trolley tension. A number of new hydro-electric generating plants are being erected, and plants which are in existence are being much enlarged.

The electrification of the Arlbergbahn, with its 31.4 per cent grades, has already begun, and the locomotives nave been ordered from German-Austrian firms. They will have a shaft pressure not exceeding $14\frac{1}{2}$ tons and a weight not exceeding 6.9 tons per meter length. Freight locomotives will have geared motors with rod-coupled wheels and express locomotives will have one motor driving by rods a blind shaft coupled to the driving wheels by rods.

Not including the newly planned lines, there are at present lines electrically operated over 575 km. of single track in Austria. Of these 66 per cent are alternating-current and 34 per cent direct-current roads.

Roads in Sweden Electrified More than in Norway

Sweden has at present 145 km. of electric railways (130 km. alternating-current and 15 km. high-tension direct-current), while Norway has 46 km. alternating-current and 27 km. direct-current roads. Ever since 1914 the Riksgränsenbahn has been hauling its heavy ore trains by single-phase, 15-cycle, 15,000-volt locomotives, which are fed from the Porjus hydro-electric plant. The southern extension of this line from Kiruna to Lulea is at present under construction. An extension to the north as far as to the seaport of Narvik is now under consideration.

The Swedish railway administration is now planning further electrification in the south, primarily for passenger traffic. A very exact study has been made as to the possible coal saving, the rentability of the lines and the best system to be chosen. The following data were derived:

	Total Efficiencies, per Cent	Relative Installation Costs	Relative Operating Costs
With three-phase, direct-current rotaries	54.0	100.0	13.2
With three-phase, single-phase motor-generators	55.0	94.5	13.0
With pure single-phase alternating current	64.7	97.2	12.6

Disturbances in telegraph and telephone lines caused by alternating-current railways have had special attention. A commission was appointed to study these causes and provide remedies. The result was a very elaborate report which was adverse to the adoption of the alternating-current system. The Swedish Reichstag approved recently the plans of a new electric alternating-current road from Stockholm to Gothenburg only under the condition that a satisfactory solution of all inductive disturbances shall be found.

Holland Plans Uniform Electrification

A uniform electrification of all the roads in Holland is planned, but the system has not as yet been decided upon. Today there are 33 km. of alternating-current 25-cycle, 10,000-volt lines and 19 km. of 1,200-volt direct-current lines in operation, but both roads, built by the Siemens-Schuckert company, are old (1908) and cannot be used as modern examples. The Dutch government, too, has authorized a committee to study electrification of railroads, including American direct-current systems and Swiss alternating-current systems. Owing to the lack of coal railway electrification will go hand in hand with a general electrification of all of Holland. Great emphasis is placed here, too, upon the perfect operation of all existing telegraph and telephone circuits.

Italy's Interest Centers Around Three-Phase

Italy has very little coal but a great amount of water power. For this reason the electrification of its railroads was considered at a very early stage. Today there are in operation 427 km. of direct-current roads, 317 km. of three-phase roads and 284 km. of single-phase roads.

The main interest is centered upon the three-phase roads, where Italy did pioneer work. The foundation for this system was laid by Ganz & Company of Budapest, Hungary, with the classic installation of the Valtellina road, built in 1900-1902 and operating very satisfactorily on 3,000 volts, three-phase, 15 cycles. Further contracts were later given by the state railways to the Westinghouse works at Vado (Ligure) under Mr. Kando's supervision for electrification of roads on the same system. The Swiss firm of Brown, Boveri & Company participated in this order by supplying locomotives for the Simplon tunnel in 1905. Direct-current roads are found west of Milan between that city and Varese. All the single-phase systems are around Rome and Naples.

Under pressure because of the present scarcity of coal, a special ministry for electrification of Italian railroads has been formed for the consideration of a plan of changing 1,870 km. of steam lines to electric lines. This undertaking, if carried out, will make about 3,000 km. of electric railways in Italy.

The largest number of electric locomotives for the Italian State Railways were furnished by the Westinghouse company in Vado (Ligure). There is at present a merger planned between the Brown-Boveri Company of Milan (branch of the Swiss house) and the Westinghouse company, in Vado, based upon an agreement between the Brown-Boveri Company, Westinghouse and Vickers, Limited, in England.

Italy has so far favored the three-phase system, which has no doubt given excellent results, with simple regeneration along the downward slopes of the Alps. It is therefore expected to adhere to this system for the future, with a possibility of change if some other method is found more advantageous. At the time when the Valtellina and Simplon roads were built a transmission of locomotive power by gears was not considered wise. Later experience, however, like that of the Lötschbergbahn and American roads, disproved this assumption and further Italian electrifications might take advan-

tage of the changed opinion. Using gears would not necessitate the choice of a very low frequency, and three-phase current could be taken from the many existing power plants of the country. It has therefore been decided to equip two roads near Rome with three-phase apparatus of a periodicity higher than 15 cycles.

SWITZERLAND'S ROADS CHIEFLY SINGLE PHASE

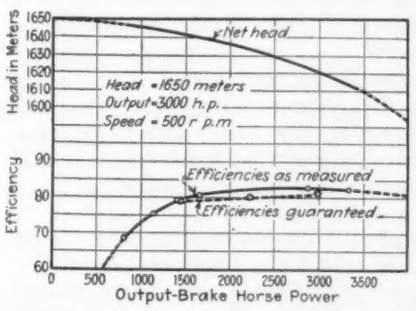
Switzerland, having no coal and an almost unlimited water-power supply depends chiefly upon electrification of its railways. There are now in operation 286 km. of high-tension direct-current roads, 115 km. of three-phase roads and 461 km. of single-phase roads. The "Swiss Study Commission of Electrification of Railways" decided in 1916 upon a uniform alternating-current, single-phase system, 15 cycles to 16⅔ cycles, employing a trolley voltage of 15,000. This system was first used by the Oerlikon company on its experimental road from Seebach to Wettingen in 1905-1907.

In 1913 the Swiss authorities decided to electrify the railway through the Gotthard tunnel, just after the Lötschbergbahn was opened for service. In 1918 the Bundesbahnen outlined and accepted a large electrification program, comprising 2,726 km., to be undertaken in three successive periods. On Sept. 15, 1920, the first electric passenger train passed through the Gotthard tunnel. The Swiss railways are 75 per cent state and 25 per cent private roads. Among the private roads the Rhätische Bahn, opened in 1920, and the Brenner Alpen Bahn are of importance. The Oerlikon works has devised a regenerative system for single-phase commutator motors. Its success cannot as yet compare with regenerative braking on direct-current locomotives.

Swiss Plant Under a Mile Head

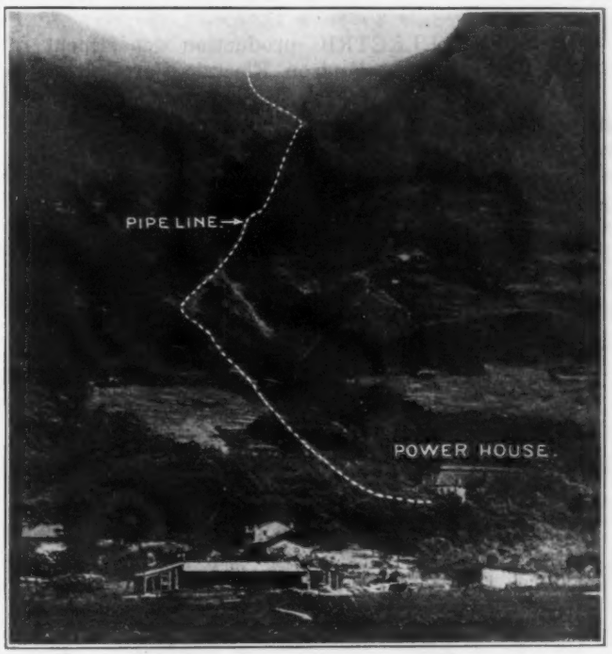
WHAT is probably the highest-head hydro-electric plant in the world is installed at Fully, Switzerland, operating at a net head of 1,650 m. (5,412 ft.). The installation is near Martigny, in the Rhone Valley, and operates from an Alpine lake 2,150 m. (7,000 ft.) above sea level. The Pelton wheels are fed by a pipe line about 4.6 km. (2.85 miles) in length. This is connected to a tunnel 500 m. (550 yd.) long, which is partly under pressure. The generating station contains four wheels, each of 3,000 hp., which run at 500 r.p.m.

Each bucket is exposed more than eight times a second to the blow of the jet leaving the pipe at a velocity of about 180 m. (590 ft.) per second. The wheels therefore had to be designed with extreme care. These wheels have an over-all diameter of 3.715 m. (12 ft.) and are of forged steel. They carry fifty-four buckets each and are so designed that no part either of the disk or the buckets is subjected to a higher tension than 1,000 kg. per square centimeter (14,200 lb. per square inch). Even in case of runaway this takes care of a speed 50 per cent above normal. The buckets are carried in a mortised groove and are fixed tangentially by formed keys driven axially between them. The whole makes a very rigid assembly with the disk.



TEST EFFICIENCIES EXCEEDED GUARANTEES

Water from the feed pipe is conducted to each turbine by a cast-steel pipe 250 mm. (10 in.) in diameter, provided with a manually operated equilibrium valve. The jet pipe fixed to the bedplate under the turbine has a nozzle of tempered steel, the water discharge from which is regulated by a steel needle which moves in the axis of the jet pipe. The needle is always inclined to open when affected by the water pressure. It can be closed by a hand-operated screw, by oil-pressure mechanism or by the automatic governor. A cast-steel deflector placed between the nozzle and the bucket wheel is raised or lowered by the action of the governor, and when lowered causes a deviation of the jet away from the bucket wheel. The governing action is said to be particularly sensitive.



PIPE LINE FOR SWISS PLANT OPERATING AT A 5,400-FT. HEAD

The results obtained on speed regulation show that when a load of 2,300 hp. was suddenly thrown off the turbine the increase in speed was only 3½ per cent, as against 7 per cent guaranteed. These percentages are in relation to the speed before unloading. The permanent variation in speed between no load and full load was 3½ per cent, this being the variation for which the governor was set. The excess pressure generated in the feed pipe during unloading was 0.6 per cent as a maximum, corresponding to a generated head equivalent to 10 m. This result was considered particularly good because of the fact that overpressure of 10 per cent was specified. The efficiency curve shows a maximum value of 82.3 per cent, which is considered remarkably good in view of the nature of the plant and the fact that the wheel was originally made of abnormal dimensions in order that the runaway speed should not exceed 50 per cent above normal. Actual tests show that friction and windage losses amount to 5 per cent of the normal power.

Further details regarding this plant and the construction of the wheels may be obtained by reference to *Engineering* (London), Dec. 24, 1920.

Checking Efficiency of Generating Plants

Daily Records Which Amount to Twenty-four-Hour Efficiency Tests Are Kept for All Units in the Generating Station—Cost of Keeping Operating Records Is Well Repaid by Increased Operating Economy

By JOHN O. FUCHS
Production Engineer United Hudson Electric Corporation, Poughkeepsie, N. Y.

AS THE ELECTRIC production department of the United Hudson Electric Corporation is responsible for the entire production of all energy throughout the system it is in this way also directly responsible for the condition and maintenance of all equipment in the steam and hydro-electric generating stations. Experience has shown that the most essential factor in the efficient production of electrical energy and also in the continuity of service is the placing of all equipment in the best possible condition and maintaining this condition at all times.

With this object in view a system has been developed of keeping an accurate check on the performance of all generating equipment to ascertain if the equipment is operating at its best efficiency, in order that immediate steps may be taken to remove from service any defective units and place the same in good operating condition as soon as possible. It has been found that the expense of keeping these records is amply recompensed by the increased over-all efficiency obtained by strict adherence to the plan.

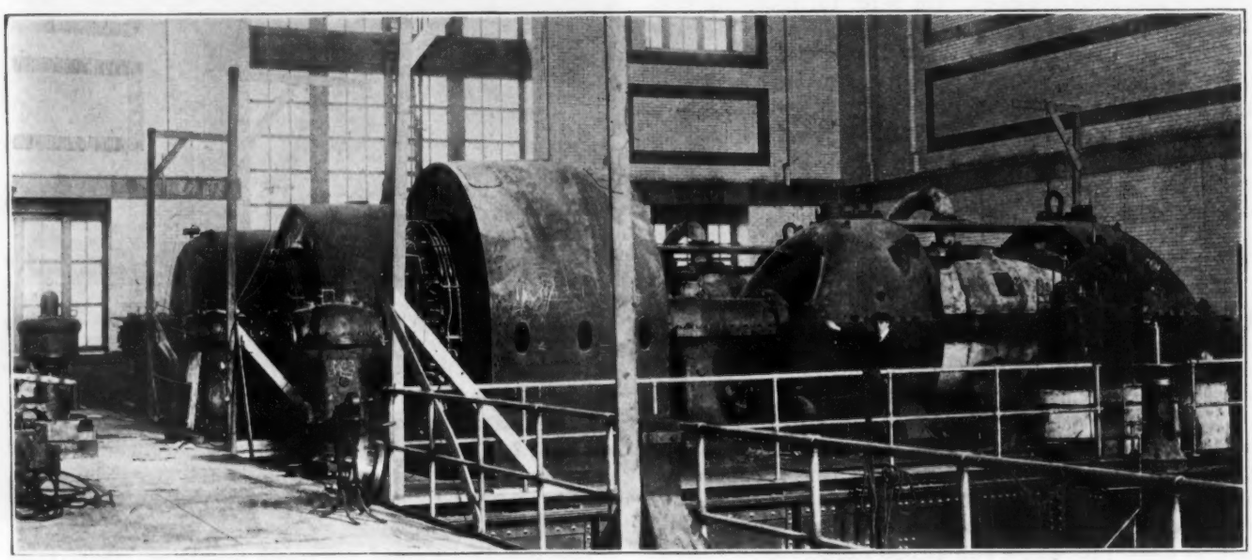


FIG. 1—CAREFUL INSPECTION OF TURBO-GENERATOR UNITS AT DEFINITE TIME INTERVALS IS ESSENTIAL

The methods of carrying out this system for the various types of equipment in the generating stations are covered in detail in this article in the hope that the data may be of benefit to other companies operating under similar conditions.

In Fig. 4 is shown the summary log sheet which is filled out each day at the Poughkeepsie Riverside station. This daily log sheet is typical of the steam generating stations of the system. The log sheet is made in three parts. Part I (not shown) gives a complete record of the number of hours each unit was in service during the twenty-four hours. The hours of service are shown by a line being drawn for any unit under the hours in which it was in service. In the case of the boilers a solid line indicates a steaming condition, a single dot indicates a single bank and a double dot a double-banked condition. The meter indexes of the various transmission and distribution circuits are also given on this sheet. The daily record of the street-lighting circuits for the city of Poughkeepsie and also the boiler cleaning and test record, together with the coal, oil and waste used, are also shown on the first sheet. On sheet No. 2 (not reproduced) are shown all the data regarding the operation of the plant for that day. This data is shown in three shifts and also for the twenty-four-hour period.

From the data given on log sheets Nos. 2 and 1 log sheet No. 3 (Fig. 4) is prepared. This sheet shows the final results from the boiler room and engine room separately and also from the plant as a whole—the final result obtained being the over-all plant efficiency.

The plant efficiency is total output ÷ total input.

The output is based on 1 kw.-hr. reduced to B.t.u. or 3415. The input is the total B.t.u. in the coal necessary to produce one kilowatt-hour. This is obtained by multiplying the load per kilowatt-hour efficiency by the B.t.u. per pound. We therefore obtain the formula:

$$\text{Plant Efficiency} = \frac{\text{output}}{\text{input}} = \frac{\text{B.t.u. per kw.-hr.}}{\text{Lb. of coal per kw.-hr.} \times \text{B.t.u. per lb.}} = \frac{3415}{\text{Item 112 (log sheet)} \times \text{B.t.u. per lb.}}$$

It can be readily understood that with the data available as shown on this log sheet a complete check is shown daily on the operation of the plant, since the log sheet is really nothing more than an actual twenty-four-hour efficiency test of the station. If any piece of equipment is not operating at its best efficiency this will immediately be shown in the results of the plant operation, and as the boiler-room and engine-room results are shown separately the trouble can be quickly traced to its source.

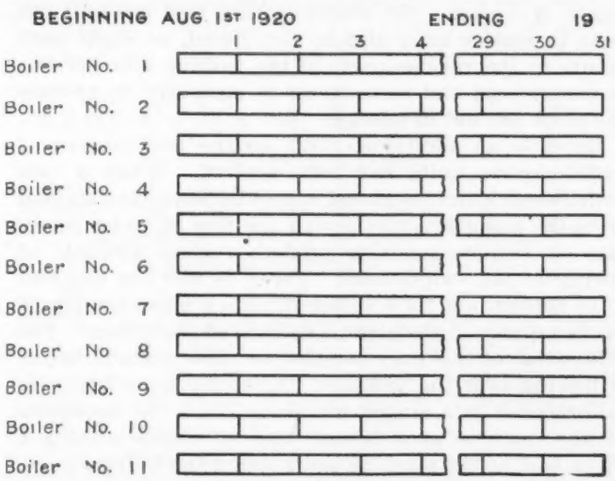


FIG. 2—MONTHLY REPORT SHOWS THE TIME EACH BOILER WAS BANKED, STEAMING OR OUT OF SERVICE FOR REPAIRS

How a Leak Costing $45 a Day Was Stopped

An examination of the log-sheet data will illustrate the value of keeping this information before the plant superintendent and the production engineer. During this period, with the grade of coal being used the average coal rate was 2.5 lb. per kilowatt-hour under normal conditions. The coal rate for this day is 2.64 lb., or an increase of 0.14 lb. per kilowatt-hour over normal conditions. When this result was obtained an investigation was immediately started to ascertain why this had occurred. The first place investigated was the boiler room, but the log sheet shows that this portion of the plant was operating satisfactorily. Referring to the engine room results, however, item No. 92, the water rate of unit No. 3, was running higher than unit No. 4. Under normal conditions the water rates of these two units are virtually the same. In investigating further item No. 98, the vacuum of unit No. 3, showed that the vacuum maintained on this unit was not so good as that maintained on unit No. 4, which immediately suggested the fact that something was wrong with the condensing equipment of this unit.

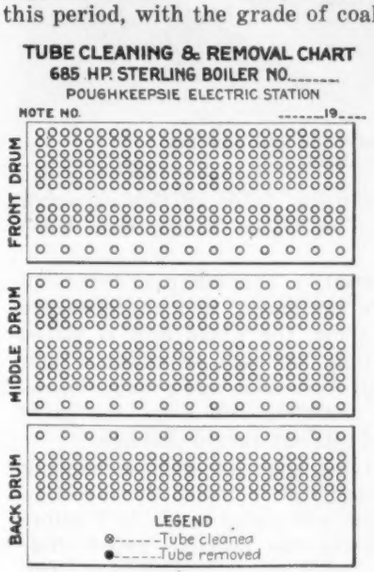


FIG. 3—CHART GIVES CHECK ON REMOVAL AND CLEARING OF BOILER TUBES

At the next favorable opportunity this unit was removed from service and the condenser inspected. It was found that a few small air leaks had developed and also that considerable dirt and scum had been deposited in the condenser by the circulating water. The condenser was thoroughly overhauled and put back in service, and satisfactory results were obtained thereafter. An increase in the coal rate of the station of 0.14 lb. per kilowatt-hour would mean a loss of approximately 6½ tons of coal per day, or a financial loss of approximately $45 per day.

Generating Units Overhauled at Least Yearly

As stated in the preceding paragraphs, a close daily check is kept of the operation of each generating unit, such as the vacuum maintained on the condensing equipment and the water rate of the turbine. Besides this daily check a complete periodic inspection is made of each unit at least once every year, or twice if deemed necessary. During this inspection the turbine casing is opened, the rotor is removed and all parts are thoroughly inspected.

CENTRAL HUDSON GAS & E.L.&C. CO.
ELECTRIC PRODUCTION LOG SHEET NO 3. DAY Tues DATE Aug 17, 1920

BOILER ROOM RESULTS

	ITEM	SHIFT NO. 1	2	3	DAY	REMARKS
82	EVAP. LBS. WATER PER LB COAL AS FIRED	5.19	8.25	9.01	7.81	
83	FACTOR OF EVAPORATION	1.107	1.109	1.108	1.108	
84	EVAP. FROM AND AT 212° PER LB. OF COAL	6.50	9.14	9.99	8.65	
85	ACTUAL BOILER H.P. HOURS	13100	31400	19900	64300	
86	RATED	34744	34744	20264	98752	
87	PER CENT BUILDER'S RATING	37.7	90.5	67.6	65.1	
88	LBS. COAL PER SQ. FT. GRATE SURFACE	12.0	20.5	11.8	14.8	
89	EFFICIENCY BOILER AND GRATE	49.0	69.5	76.0	69.8	

ENGINE ROOM RESULTS

90	WATER RATE – UNIT NO. 1					
	GUARANTEE					
91	WATER RATE – UNIT NO. 2					
	GUARANTEE					
92	WATER RATE – UNIT NO. 3	15.8	15.2	15.5		
	GUARANTEE				15.1	
93	WATER RATE – UNIT NO. 4	15.5	14.6	14.8		
	GUARANTEE					
94	WATER RATE – AUXILIARIES				5.44	
95	PER CENT – AUXILIARIES OF TOTAL				26.4	
	VACUUM PRESSURE – INCHES ABSOLUTE					
96	VACUUM PRESSURE UNIT NO 1					
97	UNIT NO 2					
98	UNIT NO. 3	1.48	2.08	1.94	1.87	
99	UNIT NO. 4	1.55	1.86	1.91		
	DEG. DIFF. VAC. TEMP AND CIR. WATER DISCH.					
100	UNIT NO. 1					
101	UNIT NO. 2					
102	UNIT NO. 3					
103	UNIT NO. 4					

PLANT AS A WHOLE

104	STATION SEND OUT K.W. HOURS	17320	48710	26630	92660	3860
105	GENERATED – NEWBURG				0	
106	– DASHVILLE	Cat-O	Hunt 840	Wood-1320	14040	
107	PURCHASED WALLKILL RIVER CO.				16300	45100
108	HONK FALLS POWER CO.				12900	209
109	O&R ELECTRIC CO (MONROE)	100	King-58		15900	
110	TOTAL SYSTEM OUTPUT				151800	
111	COST OF COAL PER K.W.H. SENDOUT.				.00860	
112	COAL PER KWH. ACCOUNTING.				2.68	
113	EFFICIENCY	3.86	2.34	2.19	2.64	
114	WATER RATE OF STATION.	22.5	19.4	21.9	20.6	
115	POWER FACTOR OF GENERATION.				64.8	
116	PEAK LOAD.	6000	7300	4800	7300	8600
117	SYSTEM PEAK LOAD				11040	57.4
118	PLANT LOAD FACTOR	56.0	83.5	69.5	52.8	
119	PLANT EFFICIENCY.	6.9	11.4	12.2	10.11	

FIG. 4—PERFORMANCE OF PLANT IS SUMMARIZED DAILY

Electrical Equipment.—A close check is kept on the condition of electrical equipment in the station, mostly by means of daily and weekly inspections by the chief electrician. The condition of the various high-tension transformers is watched by means of twenty-four-hour recording thermometers, the thermometers being regularly inspected and tested for accuracy. All oil switches, disconnecting switches, voltage regulators, etc., are periodically inspected and immediately removed from service if found defective, so that they can be placed in good operating condition.

Boilers.—A very close record is kept upon the operation of the various boilers by means of the monthly boiler report shown in Fig. 2. This report shows the time each boiler was in service, whether banked or steaming, and also when the boiler was out of service for repairs. The chart is filled in with various-colored pencils to show the above conditions, a red pencil being used, for instance, to indicate a steaming condition and a green pencil to indicate a banked condition. When the boiler is removed for repairs the chart is left blank during that time, and on the chart is placed a number which corresponds to the page in the boiler repair book on which the repairs made to the boiler at that time are listed. A chart covering tube cleaning and removal is also kept for each boiler, such as shown in Fig. 3. This chart shows all the tubes in the various boilers, and the tubes cleaned or removed are filled in with colored pencils. This chart enables the boiler-room superintendent to keep an accurate check on the tubes of each boiler cleaned or removed and also enables him, each time the boiler is taken out of service, to start cleaning the tubes where the tube cleaner left off the time before.

A complete record is also kept in the boiler repair book of any changes made to baffle openings in the boiler

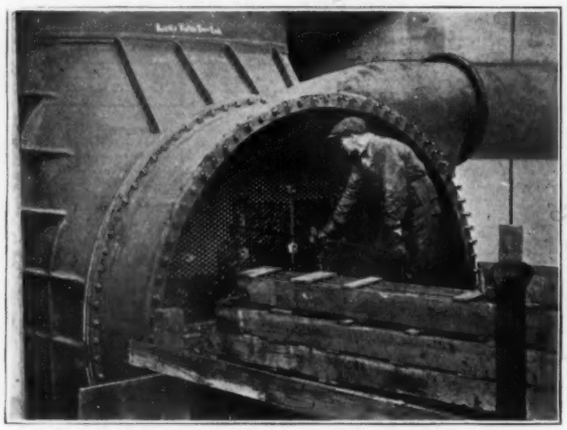


FIG. 5—CLOGGED OR LEAKING CONDENSERS WILL CONSTANTLY DRAIN THE COAL PILE

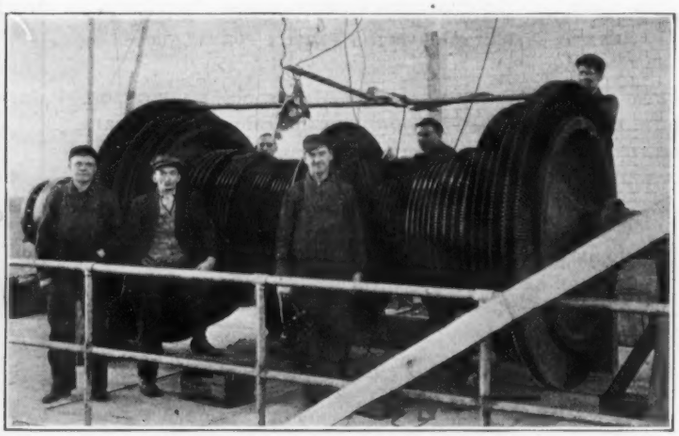


FIG. 6—TURBINE RUNNER REMOVED FOR THOROUGH INSPECTION

or any repairs made to the stoker equipment, so that there is always available a complete record of the condition of each boiler and stoker.

Coal-Handling Equipment.—For coal-handling equipment in this station a Brown locomotive crane and also a Jeffrey crushing and elevating system are utilized. The locomotive crane is driven by a separate steam boiler situated on the crane, and this boiler is designated as boiler No. 11 on the monthly boiler report, the same complete record being kept of repairs to this boiler as is kept in the case of the station boilers. The maintenance of the mechanical equipment of the crane and of the crushing and elevating equipment is left entirely to inspection, daily inspections being made of the crushing equipment and periodic inspections of the crane being made by the plant superintendent and hoist engineer.

INSPECTION SCHEME IN HYDRO-ELECTRIC GENERATING STATIONS

Satisfactory maintenance of water-driven units can be obtained by close observation of their performance. The condition of any unit can be ascertained from observing its performance with various loads by means of the instruments installed for obtaining the temperature of the bearings, windings, etc. By this means a good indication of the condition of the generating end is afforded. The performance of the water turbine is checked by the load which can be carried by the unit at various heads, and if the unit does not come up to its usual performance the cause is immediately investigated. Of course, the length of time that the unit has been in service must also be considered, as when wear occurs in the various parts of the turbine a larger loss is experienced and more water is necessary to produce the same amount of energy.

Recently an additional check on the performance of hydro-electric units has been evolved. When a new hydro-electric unit is placed in service data are obtained from the manufacturers giving the flow of water necessary at various heads to produce various amounts of energy at the switchboard. These figures are assumed to be correct, and by a series of tests a water-level gage in the tailrace of the plant is calibrated from them. The calibration of this gage can only be made when no water is flowing over the spillway. After the gage has been calibrated it is a simple matter to check the operation of any machine at a future date by simply placing a given load on the machine and reading the tailrace gage. If the efficiency has in any way fallen off this gage will register a larger amount of water flowing than when originally installed.

An annual, or if necessary a semi-annual, inspection is made of the complete equipment, and any damaged parts are replaced; in short, the whole unit is placed in good operating condition. At each inspection a complete record is kept of all work done and changes made. This record is always available and helps the plant superintendent to guard against future damage.

The daily report and log sheet of each generating station is prepared at that station under the direction of the plant superintendent and placed on his desk before noon of each day, covering the previous twenty-four hours' operation of the plant to 12 o'clock midnight. In this way he has before him within twelve hours after its completion the complete record which will enable him immediately to remove from service any equipment the log sheet shows to have affected the over-all plant efficiency. The system operator is immediately notified, and arrangements are made with him for the removal of the equipment from service.

After the log sheet has been approved by the plant superintendent it is forwarded to the office of the pro-

duction engineer, where it is again inspected and checked over. In this way the two men responsible for the maintenance and operation of this equipment are kept in direct touch with all the details of the operation of each plant.

It should be understood that only the main points in the system have been touched upon in this article, as it was the writer's intention only to give a general idea of its working.

Oil Fields of Kansas Partly Electrified

Among 5,000 Wells 1,100 Are Motor-Driven—Use of Central-Station Energy Increases Pumpage and Is Most Economical Method Tried

OF THE 5,000 oil wells in the Kansas field, which lies near Wichita, 1,100 are supplied with electric power by the Kansas Gas & Electric Company. The development is only a small part of what may be expected, as only about 15 per cent of the proved territory has been drilled in.

The cost per kilowatt-hour for electrical energy and items of like character are scrutinized but casually by the oil men. Their chief aim, and in fact their only aim, is to get the oil out of the ground, and they have been won to electric drive largely because they have been afforded an opportunity to observe its relative dependability as compared with that of steam, oil engines or gas-engine drive. Electrically operated wells produce oil about 95 per cent of the time, while wells pumped with oil or gas engines will average a little better than 80 per cent. At the present time the Kansas Gas & Electric Company could secure business amounting ultimately to $3,000,000 in annual revenue, if it were possible to secure the large amount of capital and sufficient material and labor with which to increase the generating and transmission capacity to serve this field.

WHAT ELECTRICAL ENERGY IS USED FOR

Excluding the ordinary domestic and commercial services to the various towns in and around the oil field, there are five applications of electric service which may be classed as oil applications. These are: (1) Oil-well pumping, (2) water pumping, (3) oil-pipe-line pumping, (4) oil-well drilling, and (5) electrical dehydrating operations. Of these five applications the first three are on a proved commercial basis, while the last two are more or less in an experimental state. Special interest, of course, attaches itself to deep-well oil pumping, for if this field were completely electrified, one-half of the power requirements would be found in motor installations engaged in pumping oil from the individual wells.

Water pumping is the next most important application, because in this particular field water is very scarce, and it must be pumped long distances from rivers, streams and springs for the use of the drilling rigs, as well as for domestic purposes of the oil-field inhabitants. The importance of water pumping can be appreciated from the fact that in drilling the cost of water is about one-half of the total expense. Pipe-line pumping is of course necessary if the oil is to be delivered to the various refineries situated both locally and at distances varying from 20 miles to 100 miles (32 km. to 1,600 km.).

The drilling of an oil well by motor has been lately receiving considerable attention. The electric dehydration of oil is no longer in the experimental stage in the California oil fields, but there are only two plants in the Butler County field and they are receiving considerable attention from the oil men. The consumption of electrical energy in these plants is very small, but a large number of them would represent a particularly desirable load, since it would be of a high power factor and would act as an offset to the low-power-factor pumping motors.

The transmission system of the Kansas Gas & Electric Company at the present time includes 110 miles (177 km.) of 60,000-volt lines and 45 miles (72 km.) of 11,000-volt distribution circuits. Two 60,000-volt lines connect Wichita and Eldorado by different routes and run through the heart of one of the oil pools. Four outdoor substations step the voltage down to 11,000 for distribution.

FACTS ABOUT INDIVIDUAL INSTALLATIONS

One of the most interesting features of an oil-well pumping installation is the motor itself. The type of motor used was especially developed for oil-well pumping purposes and represents experiments of six years on the part of the manufacturer in developing this highly specialized apparatus. The motors are designed for two horsepowers and two speeds. For light wells the motor best adapted is rated at 10 hp. at 600 r.p.m. and 20 hp. at 1,200 r.p.m. For heavier wells the motor is rated at 15 hp. at 600 r.p.m. and 30 hp. at 1,200 r.p.m. The reason for this dual horsepower-speed rating is best understood from a knowledge of the operating requirements. The average oil well requires from 10 hp. to 15 hp. while pumping oil from the well, but when it becomes necessary to pull out the rods, tubing or the casting considerable more power is required.

The motors employed are so designed that on the high-horsepower rating they will develop four times their full-load torque. This is very important when it comes to pulling rods, tubing and casing. These motors have been known to develop 125 hp. for periods of one to two minutes when a particularly bad job of pulling was encountered. The motor has six slip rings, and arrangements are provided for changing the motor connections from one rating to the other by a four-pole switch mounted on a frame of the motor. The pumping operations are always conducted on the lower horsepower since only a small amount of power is necessary and since the motor does not attain its best efficiency on the high-horsepower side.

Water-pumping installations are very little different from those encountered in any other part of the country, except that the relative distances to which the water is pumped are somewhat greater than are usually attempted for commercial work. The application of motors to oil-pipe-line pumping has not as yet become very general for the large pumping stations owing to the fact that units are large and have become pretty well standardized to operate by means of steam engines. The pipe lines pump the oil from local storage tanks into large tanks on tank farms or into the main pipe lines, running in many cases considerable distances, even as far as Chicago or the Gulf of Mexico. The main-pipe-line stations require motors as large as 1,000 hp. The pressure on some of the pipe lines is as high as 800 lb. per square inch (56 kg. per sq.cm.).

Owing to the present financial conditions it has been necessary to finance main-line extensions by special

service contracts, and the oil companies have raised no question when it came to advancing money for financing such extensions. The distributing lines on the leases belong to the oil companies and are usually built on a time and material basis by the utility. In the case of the Empire Gas & Fuel Company, however, installations have been on such a large scale that all the distribution lines and electrification work were taken care of by the company itself. Where desired, the Kansas Gas & Electric Company maintains the lines and charges for such maintenance on a time and material basis. The motors are sold at predetermined contract prices, allowing the oil companies to make various deductions from the completed price in case it desires to do some of the installation work or if it desires to leave out such items as concrete floors, etc. The price of the 15/30-hp. motor, which is the one in general use, is $1,225, and the cost of the complete installation is $2,150. The difference between the two prices is caused by construction of motor house, foundation, material and labor, setting up the motor, etc.

Because these motors are operated in nine cases out of ten by oil-field labor that knows nothing whatever about the operation of electric apparatus, the company has organized a service department to look after the customers' motors when they so desire. An experienced motor man makes two inspections a week and where necessary makes various minor repairs and adjustments. For this service the company charges the customer $3 per motor per month.

The data in Table I have been worked to show the pumping costs both with motors and with gas engines, and they show that the savings for one month are considerable on a lease of sixteen wells.

The foregoing data represent a particular instance which, while not entirely typical, can be taken as a basis for commercial work. Experience shows that about 4,000 kw.-hr. is required per month to pump the average well, and that the cost of this service at the company's present rate amounts to about $80 per well per month, while where there are a number of wells on lease the average cost of pumping with oil or gas engines is about $6 per day.

TABLE I—PUMPING COSTS WITH MOTORS AND WITH GAS ENGINES COMPARED

	Motors	Engines
Total kilowatt-hours used on W— lease	27,485	.....
Total kilowatt-hours used by five pumping motors	21,910	.....
Average kilowatt-hours per motor	4,382	.....
Average cost per well at $0.15 per kilowatt-hour	$65.73	.....
Cost per month per well if all sixteen wells were equipped with motors	43.82	.....
Add $3 for service charge	46.82	.....
Cost per month per well if all sixteen wells were equipped with gas engines	.....	$25.00
Add $10 for repairs	.....	35.00
	Six Men	Nine Men
Men to take care of equipment per month	$600.00	$900.00
Cost of equipment per month	$81.32	81.25
Men's time, gas and electricity added here	1 per cent	7 per cent
Loss at $2 per barrel per month	$559.13	$3,913.91
Saving of motor over gas engine per month	3,553.94	.....

All oil-field power is furnished on what is known as Schedule H, oil field power rate. This schedule is reproduced as Table II.

The Empire Gas & Fuel Company is said to be by far the largest individual user of electric power for oil-field work in the country. At the present time it has approximately 1,000 motors in operation, 750 of which are used for pumping wells. This company takes its power from the 60,000-volt transmission line and through its own substations transforms it to 11,000 volts for field distribution.

At the present time the company has fourteen electric drilling equipments with which it does all of its drilling in the Eldorado fields. So far the reports show that electric drilling equipment more than pays for itself on the first well in savings made over the use of steam power. Drillers as a rule do not take kindly to changes, but we have yet to find one who has operated electric drilling equipment and has not become a convert.

TABLE II—OIL FIELD POWER RATE

RATES: $2 net per month per contract hp., which entitles consumer to use during such month 30 kw.-hr.

	Net Rate per Kw.-Hr.
For the next 500 kw.-hr. used per month	$0.04
For the next 3,000 kw.-hr. used per month	.03
For the next 5,000 kw.-hr. used per month	.02
In excess of above-stated amounts	.01

PAYMENTS: The above-mentioned net rates apply only when bills are paid within fifteen days from the date thereof. When not so paid, the gross rates (being the above-mentioned net rates plus 5 per cent on the first $200 of bill and 2 per cent on the excess of bill) apply.

The Empire company does all of its water pumping for the Eldorado fields with motors. Approximately 20,000 bbl. per day is pumped from the Arkansas River, 30 miles (48 km.) distant, and is relayed from at least one station in the field. All of the company's shops are electrically equipped, and a large amount of electric lighting is used throughout the field.

It is impossible to determine accurately the economic benefits obtained from electric drive, but it is safe to say that electric motors more than pay for themselves in six months or a year, owing to fewer shutdowns, as compared with gas or oil engines. Operating costs are also reduced. Formerly where one pumper operated from four to six wells with a gas engine he can now operate fifteen to twenty with a motor. Rod trouble, as well as other troubles, is reduced. Cost of labor is minimized, as well as the number of stock repair parts required.

Operating experience shows many advantages of electric power in oil field operation. Of these the most important are economy in fuel, economy in labor costs, economy in time, possibility of accurate records, fewer accidents, less fire hazard, simplicity in operation, cleanness and quietness of operation, low depreciation and low repairs and maintenance cost.

It has always been assumed that oil-field operators were antagonistic to new methods, but it has been found that the pumpers and other field men have taken kindly to electrifying the fields.

HISTORY *is to be studied and applied not for the purpose of advocating reaction. It is not the accurately informed who continually appeal to the good old times to the disparagement of the present. True history while ever a conservative force, yet holds the only warrant for real progress. It is ignorance of its teachings which leads men of good intentions to advocate either reaction or revolution, and a knowledge of its forces which aids men to promote the public welfare. That form of government which is based on the rule of the people through a republic in principle is the ultimate. There is great opportunity for improvement of administration. It is not enough that correct principles be declared in institutions, unless they result in corresponding action in practical life. Perfection requires not less effort, but more. Great privileges mean great responsibilities.*—CALVIN COOLIDGE.

Dangers of Over-Complacency

This State of Mind One that Should Be Sedulously Shunned by Operators and Employees of Every Rank—Above All, the Complaint Department Is the Last Place for Such an Attitude to Be Assumed

By S. M. KENNEDY
Vice-President in Charge of Business Development and Public Relations, Southern California Edison Company

MORE than a century ago a noted Frenchman declared:

"Complacency is a coin by the aid of which all the world can, for want of essential means, pay its bill in society. It is necessary, finally, that it may lose nothing of its merits, to associate judgment and prudence with it."

One dictionary defines the word complacency as "tranquil satisfaction of mind and heart." . . . It will be observed therefore that complacency is not necessarily a reprehensible attribute, but it is over-complacency —the complacency without judgment and prudence— that requires attention and frequently correction.

In the public utility business in America, and especially on the Pacific Coast, during the past two or three years there has been a change of front in some particulars. In the earlier days of the development of the electrical industry and for a long period subsequently the central-station company was compelled to educate, illustrate, demonstrate, advertise and solicit in order to sell electric service. Today with many companies the conditions are entirely changed, and in some instances the motions have been completely reversed. Just at the time when the persistent labor of years was beginning to bear its best fruits, for justifiable reasons, the supply of surplus energy became diminished and in some instances gave out entirely. Applications for service poured in faster than ever before. "Prospects" that once were coy and had to be coaxed even to consider the proposals made seemed to change overnight and became friendly and familiar, and "prospects" that had been almost persuaded to change to electric drive quite suddenly became insistent in their demands and talked of their prior rights, because of offers previously made to them. The managers of power companies, on their part, who once were worried how they could get new business began to worry how they could keep new business from coming in so rapidly.

THE OFFENSIVE AIR OF SUPERIORITY

Of course, this was considered a temporary condition —one that would last only until additional funds or more power might be available—but it lasted long enough to bring about an undesirable attitude in some directions. Big and little applicants, going into a power company's office in good faith to ask for electric service, were often received by employees and frequently by managers with an air of superiority as much as to say, "Our time has come and you may now await our pleasure." Then, with a "why should we worry?" tone and attitude, the anxious would-be customer was told that all the present supply of power had been sold, that there were three thousand seven hundred and sixty-five applications ahead of his, that he had better get busy and patch up his old plant and apply again for service at a later date, and if the Fates were kind maybe he would get it. Unfavorable comments on the power shortage situation in local papers were allowed to appear without any attention being given to them or the real causes of the embarrassing conditions being stated. No anxiety on the power company's part to explain, assist, modify or ameliorate the troubles—just an attitude of exaggerated complacency.

During this period there has accumulated a real danger to the utility company, and a reaction may be brewing that may strike at its very existence or at least impair its standing, usefulness and earning power. The public has a long memory—particularly for real or fancied wrongs—and when the right time arrives it will recall the over-complacent attitude of the company's representatives at a time when a little interest, anxiety, courtesy and consideration would have been more acceptable. If the rough edges of some of the spoken words had been trimmed off, it would have left a better feeling—and there would be fewer hurts and scars to be healed later. Too much complacency on the part of employees is irritating to a utility company's customers and also to the public. Persistence in this attitude should likewise be irritating to the responsible executives and managers of the utility company. Complacency is a twin sister of apathy and a near relative of contentment, and contentment often means stagnation. The managers of utility companies are trustees charged with heavy responsibilities—first to the public in connection with the needed service they supply, and second to the security holders, who by their confidence in the enterprise make the service possible. At no time can a utility company afford to be complacent and remain complacent, and least of all when things appear to be coming its way and it has the semblance of prosperity. Then is the time it needs most of all to ingratiate itself with its customers and intrench itself in public favor. The public may be kept quiescent and even pleased if it obtains what it wants—that is, good service under reasonable conditions—but no company ever accomplished this result through an attitude of complacency. On the contrary, over-complacency at critical times can easily undermine all the good work which may have been done previously and create a condition of antagonism and unrest which will surely hamper the business and ultimately decrease the revenues.

A WORD TO THE DISTRICT MANAGER

The "bug" called complacency has another direction of attack which is particularly dangerous to the company. This is through its district managers. The district manager is the head of the organization in his territory and the representative of the company as a whole and all for which it stands. It is his duty to be

a big man in the community, just as the company is a big and necessary factor in its business life. For this reason the district manager should be actively interested in all the business and community organizations—political organizations excepted. He should have a place in the chamber of commerce, board of trade, business men's clubs, improvement associations and similar associations, for they are useful and educational, and all of them more or less affect or are affected by the company's business and interests. Complacency in this direction is dangerous. The desire to let the other fellow do it should be throttled. For the district manager to say he is too busy and cannot keep up with these affairs is only an excuse. He may be busy doing less important work which might be done just as well by assistants. His duty is to know all that is taking place in his district. Perhaps he is sometimes weary and would like to stay home. It takes a mighty conscientious man to tell the difference between when he is tired and when he is just lazy. Over-complacency is liable to make a man think he's tired when he's only looking for an excuse to sit down and rest. Interest and anxiety to miss nothing are good antidotes for laziness, and these go with the brand of complacency that is associated with judgment and prudence. Most men want advancement and prosperity—that's the incentive that beckons through the daily grind of work. A man must go after what he wants, and what he doesn't want will come after him. Complacency is a finely disguised enemy of ambition—but an enemy just the same.

Complacency in Complaint Department

If there is one place more than another where a central-station company cannot afford to be complacent, it is in the complaint department. This observation applies not only to the manner in which complaints are received but also to the way in which care is taken of them. If there were less complacency in some directions, many complaints could be averted. Sometimes the operating department knows of conditions where lines or transformers are overloaded, where voltages may be low or interruptions may occur; but those in charge "take a chance" about the service, and it goes without saying that complaints usually follow. Sometimes fuses blow out, lamps burn out and appliances get out of order because of unnecessarily high voltage. Some one in authority has said, "Never mind; we'll take a chance." Again complaints pour in and consumers are inconvenienced, just because there has been too much complacency. Bills sent out for monthly consumption are not always clear and readily comprehended, and the consumer complains because he does not understand the calculation or thinks he is overcharged. This is indicative of too much complacency in the bookkeeping department. A collector is sometimes known to be a "grouch," or perhaps he is only temperamental, but at any rate customers complain about the treatment received. Some one is to blame, and probably it is that collector's chief who is too complacent about his work and takes a chance with the grouchy employee.

It is better to avert complaints if possible, but if they exist, the reporting of them should be welcomed. In the first place it gives the company a chance to remedy wrong conditions and to improve the service, and in the next place it creates an opportunity to make real friends. Nothing will please a patron more than to have his complaint received with polite consideration and to have the trouble remedied promptly. He is not only pleased but often he feels flattered that he, one of thousands of customers, by simply saying a word to a clerk in the company's office or over the telephone should start something which produces quick action and desired results. He talks it over with his wife and tells his neighbors about the splendid service furnished and how the big company had given his complaint special consideration. There is a fitting time for the company to play its trump card in connection with each complaint filed. After the complaint has been courteously recorded and passed on to the trouble department for prompt action—and after everything is supposed to have received attention—some one in the office, preferably a girl with a pleasing voice, should call the complaining customer on the telephone and inquire if everything is now satisfactory. If something yet remains to be done, it can be reported and cared for, and if everything is as it should be, the office knows it. But in either case the consumer is more than pleased, because his individuality is recognized and he feels that he counts for something.

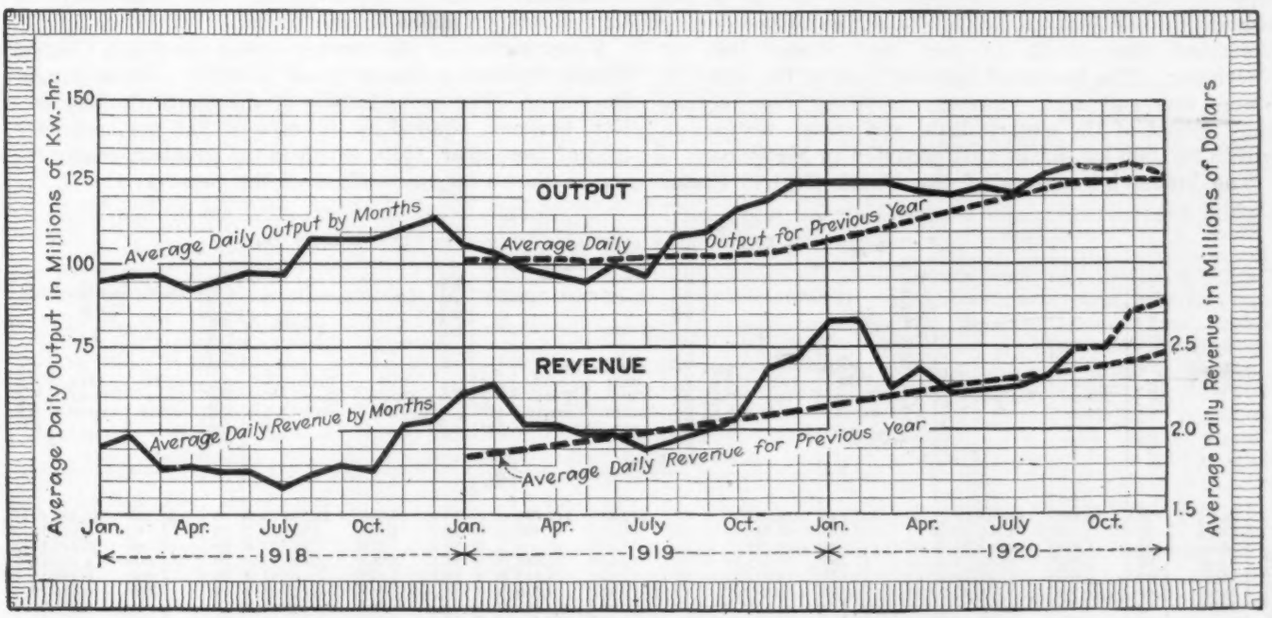
It is not altogether improbable that some day the public utility commissions will measure the standing of a central-station company by the character and quantity of complaints received and the manner in which such complaints are disposed of. When complaints are at a minimum the indications are that service is supplied at a high standard, and when complaints are many and poorly handled, then something must be wrong and some one is to blame. At any rate, in some way the commission will find out what is wrong, if the company managers don't, and the trouble will be found to be over-complacency on the part of some one who is likely a square peg in a round hole. If absence of complaints is to be one measure of good service and the proper reception and care of complaints is to be another, then some company organizations had better be reorganized. Complacency and good service have never yet traveled together and met with success. One of them must be sacrificed—and it is up to the district manager to indicate which.

Personal Appearance and Complacency

There is one other brand of complacency that is a menace to the district manager and all his assistants. It is an individual matter—sometimes even considered a delicate subject—and that is complacency regarding personal appearance. A sore cannot be cured by covering it up; it must be open to the sunlight and air. There is no use sidestepping this subject as it is important alike to the individual and the company. Some one once said that "a man may be known by the company that keeps him." As far as it goes the expression is all right, but it might well be paralleled by saying that "a company is known by the men it keeps—and that is the only way it is known." If such is the case, does each company employee, each man who is regularly seen and known as a company representative, do his part by watching his personal appearance and safeguarding the impression he creates? The answer is no. There are men in the district-manager class who set very poor examples to those under them. Then down the line there are men who ought to know better who are hurting themselves and hurting the company by their complacency as to their personal appearance. Unshaven faces are unpardonable on men whose work requires them to meet the company's customers in any capacity.

In some parts of the world where conventionalities are more closely observed a man who had to meet the public for a business organization would lose his position if he appeared for a day's work with an unshaven face. Clothes don't have to be new, but a little pride and effort will keep them clean. If a collar is supposed to be white, then it should be white as the snow on the mountain tops. If shoes are supposed to be black, then they should be as black and shiny as the face of a native in Central Africa. If a man is going to apply for a position, he usually endeavors to create a favorable impression by making a good appearance. He should be just as particular after he gets a position as he was when seeking it. Sometimes employees a little bit down the line think they are not observed and that their full value is not appreciated. If such employees only knew how much they are observed, their worries in that direction would soon cease. Some wonder why one man is sent up and another remains down. There is always a reason for promoting one man and passing by another. Sometimes the reason for staying down is too much complacency—too much self-satisfaction and not enough mental and physical activity. The well-managed utility company is jealous of its reputation and jealous of the reputation it makes through its representatives. Personal appearance is not everything, but it means a great deal, and each employee owes it to the company as well as to himself to give close attention to the impression he is making in this direction and see if he can improve it. If he is in doubt, let him ask some one who will tell him the truth. A writer has said: "Man was made for growth. It is the object, the explanation, of his being. To have an ambition, to grow larger and broader every day, to push the horizon of ignorance a little further away, to become a little richer in knowledge, a little wiser and more of a man—that is an ambition worth while." To reach out toward these ideals might well be the desire of every public utility employee. As he progresses he will be of greater value to himself and greater usefulness to the company he represents; but if his ambition becomes stimulated and he has his eyes glued to the upper rounds of the ladder of success, he will have said goodby to complacency until such time as he reaches his desired goal.

Output Decreases While Revenue Increases



CENTRAL STATION RETURNS FOR THE MONTH OF DECEMBER, 1920

RETURNS of central-station business for the month of December received by the ELECTRICAL WORLD indicated that the daily operations of the electric light and power industry during that month were only slightly below those of November, despite the industrial depression prevalent throughout the country. An increase of 6.1 per cent over December, 1919, is shown, which is far from discouraging. Moreover, another record of $2,780,000 average daily gross revenue was hung up during the month, so that while the output was practically at a standstill the revenue was materially increased.

Every section of the country except New England reported a decreased output as compared with November. Federal government reports on idle and active machinery in the woolen and worsted industries show that the highest point of curtailment for the year 1920 was reached during December and amounted to about 50 per cent, and that much of the active machinery was operated on short time. The shoe industry of New England was operating at about 40 per cent of normal, and other industries showed somewhat similar curtailments. In spite of these material decreases in power demand, however, the increased lighting load was sufficient to increase slightly the output of this section over

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy			Percentage of Installed Ratings Represented	Kw.-Hr. Output		
		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase
Jan.	57	$46,614	$39,002	19.8	67	2,581,096	2,186,732	18.0
Feb.	63	45,881	37,502	22.1	69	2,494,764	1,986,493	25.3
Mar.	65	46,155	36,840	25.0	70	2,698,890	2,103,587	28.0
April	65	45,547	36,541	24.5	70	2,603,692	2,098,559	24.1
May	65	43,888	35,512	23.4	70	2,631,560	2,179,916	21.2
June	66	44,434	35,528	24.5	71	2,630,831	2,175,645	20.2
July	66	46,608	36,265	28.5	71	2,677,131	2,234,215	20.0
Aug.	66	47,410	36,713	29.1	71	2,769,175	2,303,099	20.1
Sept.	66	49,224	38,209	28.5	71	2,734,179	2,327,460	17.4
Oct.*	66	51,370	41,055	25.1	71	2,797,625	2,499,488	11.9
Nov.†	66	54,440	44,673	21.8	71	2,757,447	2,493,601	10.4
Dec.‡	66	57,100	48,341	18.3	71	2,792,687	2,627,893	6.1

* Includes estimates for thirty-one companies, representing 5.5 per cent of the total installed rating of all central stations.
† Includes estimates for forty-four companies, representing 6.2 per cent of the total installed rating of all central stations.
‡ Includes estimates for eighty-seven companies, representing 17.9 per cent of the total installed rating of all central stations.

November, although the total output in the section was 7.2 per cent below that of December, 1919.

In the Pittsburgh and nearby districts independent iron and steel companies were running at only about 25 per cent capacity during December, but most of the Steel Corporation mills were operating at 90 per cent capacity. Operations in the textile industry of the Middle Atlantic States were from 60 to 70 per cent below those of 1919, and other industries in this district reported similar decreased operations, but to a less degree. In the South Atlantic States the output during December was about 13 per cent under that of November. The increased lighting load of the Atlantic States was sufficient, however, to bring the average daily output of the electric light and power stations to within 500,000 kw.-hr. of that reported in November.

The industrial centers of the North Central States were not so hard hit as were the industrial centers of the New England and Atlantic States. Some of the big steel mills in this section were working at 80 per cent capacity during December, but the independent iron and steel mills were operating at only about 35 per cent. The power demand of the automobile industry was about 30 per cent under that of December, 1919, and the leather, boot and shoe industries called for some 31 per cent less power. The increased lighting and heating load was sufficient to overcome a large portion of this decreased power demand, resulting in a net loss of about 4 per cent in daily output under that of November.

Curtailment in operations was general throughout the metal-mining and petroleum industries of the South Central States, but the textile industry of that section reported curtailment of less than 2 per cent. These decreased industrial activities were to a large extent offset by increased lighting requirements, but the output of the electric light and power plants of the section was about 5 per cent under that of November.

Mining operations in the Mountain States were slightly decreased during December, and non-employment was greater in this section than in any previous period during the last three years. The South Pacific section reported a decreased demand for power, while the North Pacific section reported increased output, although non-employment in the latter section was very large. The entire Mountain and Pacific Section reported a loss of about 2 per cent in daily output under that of November, which is approximately the same decrease that was reported for similar periods in 1919.

Every section of the country except the South Central States reported a record gross monthly income during December. The gross income of the South Central section, however, showed an increase of 25.5 per cent over that of December, 1919, which is the greatest yearly increase shown by any section of the country.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States				Atlantic States				North Central States				South Central States				Pacific and Mountain States			
		Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase
REVENUE	Jan.	78	$5,635	$4,718	19.8	59	$17,659	$14,625	20.9	51	$12,885	$10,799	19.6	53	$3,047	$2,538	19.9	75	$7,388	$6,322	16.1
	Feb.	82	5,354	4,368	22.1	61	17,245	14,343	20.4	55	13,191	10,403	26.0	53	2,949	2,360	24.7	79	7,142	6,028	18.3
	Mar.	82	5,136	4,044	27.0	63	17,696	14,299	23.7	57	13,270	10,469	26.5	54	2,910	2,287	27.8	79	7,148	5,741	24.2
	April	82	5,087	3,943	29.0	64	17,700	14,383	23.5	57	12,690	10,042	26.9	54	2,952	2,181	35.2	79	7,118	5,992	19.2
	May	82	4,897	3,741	30.1	64	16,624	13,631	21.9	57	12,471	9,853	26.8	54	2,829	2,140	32.0	79	7,067	6,147	15.1
	June	82	4,948	3,778	30.5	65	16,525	13,449	22.1	57	12,412	9,776	26.9	54	2,849	2,127	33.9	79	7,700	6,398	20.5
	July	82	5,009	3,802	28.5	65	16,899	13,438	25.5	57	12,822	9,793	30.9	54	2,747	2,194	35.0	79	9,131	6,948	31.5
	Aug.	82	5,075	4,093	24.0	65	17,210	13,731	25.9	57	13,497	10,151	32.9	54	3,168	2,281	38.1	79	8,460	6,457	31.1
	Sept.	82	5,409	4,296	25.9	65	18,081	14,456	24.5	57	13,834	10,522	31.5	54	3,262	2,386	36.5	79	8,638	6,549	32.0
	Oct.	82	5,675	4,623	22.7	65	19,201	15,722	22.0	57	14,458	11,667	23.9	54	3,504	2,551	37.3	79	8,532	6,492	31.5
	Nov.	82	5,817	5,014	17.5	65	20,924	17,112	22.1	57	14,993	12,537	19.5	54	3,851	2,906	32.5	79	8,775	7,104	23.5
	Dec.	82	6,574	5,703	15.1	65	22,357	19,090	17.1	57	15,377	13,109	17.0	54	3,779	3,008	25.5	79	9,013	7,431	21.2
KW.-HR. OUTPUT			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan.	78	207,158	159,773	29.8	60	853,057	717,303	19.2	69	841,841	731,758	15.2	56	140,736	117,677	19.9	75	538,304	460,221	16.2
	Feb.	82	187,264	148,103	26.2	62	809,865	672,836	20.1	73	858,939	663,523	29.4	56	130,473	98,098	33.0	79	508,223	403,933	26.1
	Mar.	82	198,603	148,512	33.7	64	897,327	711,828	26.0	74	913,659	711,761	28.1	56	137,306	102,545	33.6	79	551,995	428,941	28.6
	April	82	187,174	144,922	29.1	65	883,264	701,778	25.9	74	857,467	687,751	24.7	56	135,140	99,877	35.2	79	540,647	464,231	16.7
	May	82	188,566	148,186	27.5	65	854,631	711,276	20.0	74	862,127	700,095	23.5	56	137,779	98,815	39.2	79	588,457	521,544	12.6
	June	82	189,934	149,607	26.5	66	865,714	721,688	19.9	74	855,013	681,780	25.5	56	132,733	99,660	33.2	79	587,437	522,901	12.?
	July	82	190,668	159,000	20.0	66	881,241	714,485	23.5	74	841,351	702,302	19.7	56	138,937	106,460	30.1	79	614,934	551,959	13.4
	Aug.	82	194,028	171,002	13.5	66	905,170	728,097	24.2	74	891,712	750,787	18.6	56	147,082	111,573	32.0	79	631,183	541,640	16.5
	Sept.	82	194,730	170,593	14.1	66	905 872	758,737	19.5	74	878,237	758,017	15.9	56	147,524	113,649	30.0	79	607,816	526,464	15.5
	Oct.	82	196,310	191,132	2 7	66	964,739	841,694	14.5	74	896,241	817,757	9.5	56	157,267	126,769	24.1	79	583,068	522,136	11.7
	Nov.	82	193,262	183,580	5 2	66	952,933	825,132	15.5	74	911,573	851,577	7.0	56	144,759	125,335	15.0	79	554,920	507,977	9.2
	Dec.	82	210,993	226,947	-7.1	66	971,541	908,173	7.0	74	907,693	839,933	8.1	56	142,077	134,250	5.8	79	560,383	517,580	8.8

Progress of the Superpower Survey

Annual Saving to Railroads of $90,000,000 Through Electrification and of 4,000,000 Tons of Coal by the Utilities, Together with Legislative and Financial Program, Told of by the Secretary of the Interior in the Report to the President

ALTHOUGH the complete report on the Superpower Survey of the Atlantic seaboard now being made by the Geological Survey will not be ready before the end of June, the work has progressed to the state where it has been found possible to make a brief statement showing the progress made so far and in a way indicating the scope of the investigation. Such a report was made last week by Secretary of the Interior John Barton Payne to President Wilson. It contains statements of probable economies in railroad, industrial and electric utility operations, recommendations for legislation and a summary of the suggested plan for financing a superpower system. The complete report follows:

The Congress, in appropriating for the Geological Survey, June 5, 1920, provided for the survey of power production and distribution in the United States, including the study of methods for the further utilization of water power and the special investigation of the possible economy of fuel, labor and materials resulting from the use in the Boston-Washington industrial region of a comprehensive system for the generation and distribution of electricity to transportation lines and industries.

While the final report cannot now be made, it seemed to me wise that a progress report should be submitted giving results thus far accomplished, and a brief statement of scope:

An organization was effected under the Geological Survey with offices for the engineering staff in New York City. The engineering staff includes William S. Murray as chairman, Nathan C. Grover, chief hydraulic engineer of the United States Geological Survey; Ozni P. Hood, chief mechanical engineer of the Bureau of Mines; Lorin E. Imlay, division engineer for the subjects of power and transmission; Henry W. Butler, division engineer for industries, and Cary T. Hutchinson, division engineer for railroads, with Henry Flood, Jr., as engineer-secretary. The engineering staff has been aided by the hearty co-operation of an advisory board of business and professional men, who accepted appointments for this special service. Of this board Prof. Lester P. Breckenridge of Yale is chairman, and the various interests connected with this investigation are represented as follows: Magnus W. Alexander of Boston, representing the National Industrial Conference Board; Edward G. Buckland, vice-president New York, New Haven & Hartford Railroad; Charles L. Edgar of the Boston Edison Company, representing the National Electric Light Association; Abraham T. Hardin, vice-president New York Central Railroad; Herbert Hoover, representing the mining industry; Lieut.-Col. William Kelley, U. S. A.; Elisha Lee, vice-president Pennsylvania Railroad; Dr. Arthur D. Little of Boston, representing the electrochemical and by-products industries; James H. McGraw, president McGraw-Hill Company, Inc., representing the technical press; John H. Pardee of New York, representing the American Electric Railway Association; Henry Cleveland Perkins of Washington, representing the mining industry, and Matthew S. Sloan of the Brooklyn Edison Company, representing the National Electric Light Association. The progress thus far made warrants the belief that the report will be completed by June 30, 1921.

Having in mind the objects of the Superpower Survey, namely, (1) allocation of the amount of waste in labor, coal and other materials due to the improper form of power generation and distribution within the Boston-Washington zone, and (2) recommendations regarding a regional power system by means of which these wastes may be eliminated, the Superpower report naturally divides into three divisions—(1) physical, (2) legal and (3) financial.

With regard to the physical aspect our investigation has been concerned with power necessary to (a) railroads, (b) industries, (c) utilities, and (d) a system of centralized electric generation and transmission to supply their power requirements through 1930.

Railroads

We find that there are twenty Class 1 railways included in the Superpower zone. These are divided as follows: First track, 14,500 miles; second track, 6,500 miles; total trackage (including yards and sidings), 36,000 miles. There are a total of 10,000 steam locomotives, of which 44 per cent are freight, 29 per cent passenger and 27 per cent switching. The total annual railroad coal consumption for 1919 was 19,000,000 tons.

Apparently one-third of this mileage can be economically electrified, including the greater part of the double-track mileage. Owing to lack of traffic density upon the branch lines these cannot be profitably electrified. The above 33 per cent of mileage will carry more than 50 per cent of the traffic, and by preferential arrangement of routes probably 60 per cent of the total traffic could be put over this mileage. Through the electrification of the above mileage a fuel saving of 6,000,000 tons, or $40,000,000 yearly, would be effected. Added to this saving will be $50,000,000 annually in favor of electric vs. steam engine repairs and maintenance.

The total unit cost of electrification will be approximately $40,000 per mile of main-line track, which with 12,600 miles to be electrified would cost $500,000,000. In addition, yard and siding trackage would call for $300,000,000, or a total of $800,000,000. This sum will cover the necessary construction and equipment for the railways.

The electrification above outlined will displace approximately 7,000 steam locomotives, which at a salvage value of $22,500 each will credit the electrification estimate with approximately $150,000,000, leaving a net investment of $650,000,000, which taken in connection with aforementioned savings of $90,000,000 per annum would return approximately 14 per cent on the investment.

Industries

There are approximately 50,000 industrial plants in the zone which either purchase or generate power. The Bureau of the Census is at present compiling the statistics of the 1919 Census of Manufactures. It is heartily cooperating with the Superpower Survey and will prepare on a form made up by this survey the power and fuel statistics for the Superpower Zone, which will show the power and fuel requirements in the thirty-six major industries in the following classification of plants: Plants which do not use any power, plants using only steam power, plants purchasing electric power and plants not in the above classes, classified as to size.

As soon as the tabulations are completed by the Bureau of the Census, we, in conjunction with experts in the various industries, will analyze and ascertain what possible fuel savings could have been made by the Superpower System in 1919. From the data at hand a saving of between 6,000,000 tons and 8,000,000 tons of coal is indicated. In the anthracite coal mines of Pennsylvania, by means of electrification and the supply of superpower, a conservative estimate based on actual tests shows a saving of 6,500,000 gross tons of anthracite. We are at present preparing cost estimates for completely electrifying the anthracite mines.

The data required of the industrial division will be ready by May 1 for assembly in final form.

Utilities

A large saving of coal can be effected through the more efficient generation of

power by the new superpower stations. We find that the average rate of coal consumption for present central-station output is 2¾ lb. per kilowatt-hour. Power can be produced in the Superpower System at an average rate of 1¾ lb. per kilowatt-hour. The present central-station output of coal-generated power within the zone is 8,000,000,000 kw.-hr. Therefore one pound saved per kilowatt-hour will conserve 4,000,000 tons of coal annually.

Electric Power Generation and Transmission

The location of the large superpower stations and their attendant transmission lines is related to the establishment of load centers throughout the Superpower Zone to which power will be transmitted from them at minimum distance. To date it is indicated that some twenty load centers will be established. By March 1 sufficient data will be at hand to establish these load centers, after which the location of new superpower stations and their interlinking transmission systems can be promptly determined in the zone.

The development of power outside of but for transmission to the zone is being most carefully considered, having relation to the St. Lawrence River, other hydro-electric powers and the bituminous coal mines. It has been agreed among the experts of the country that 250,000 volts will be an acceptable voltage for the transmission of power from distances greater than 200 miles and at about half that value for the zone itself

A conference with the coal authorities indicates that a fair figure to take for the average price of coal during the period of 1919 was $2.90 per ton at the mine, and during the period from that date to 1930, $3.50 per ton.

With regard to water power for the zone, a summation of the possible outputs from the Potomac, Susquehanna, Delaware, St. Lawrence (American rights), Raquette and the Adirondack powers indicates that for an average year there will be available 12,000,000,000 kw.-hr. and for a minimum year 8,360,000,000 kw.-hr., the plant capacity being 2,300,000 kw. to furnish this amount of energy. It is of interest at this point to state that in 1930 the total power requirement in the Superpower Zone indicated by projected growth curves will be 48,000,000,000 kw.-hr., of which amount the Superpower System could supply 36,000,000,000 kw.-hr. This, therefore, indicates that the water-power supply can be but from 20 to 25 per cent of the total. This fact forces the conclusion that most careful consideration must be given to the efficient development of power from coal.

The report will contain a chronology indicating time and location of superpower stations to be constructed in the order of their requirement, giving savings to be effected as their serial installation is made.

I am pleased to be able to say that through the unusual co-operation of the public utilities, the railways and the industries the completion of the work will be, after May 1, substantially a matter of computation and tabulation.

Concerning legislative and financial status the following paragraphs represent the general expression of opinion at the Washington meeting of the advisory board on Feb. 18.

Legislation

Legislation should take the form of an act permitting the formation of a corporation authorized to take by eminent domain lands or interests therein necessary or appropriate to the construction, maintenance and operation of lines for the transmission of electric energy. Such legislation may be by a separate act or by an amendment to the Federal Power Commission law.

As a condition precedent to the formation of such a corporation the proposed incorporators should be required to apply to the Federal Power Commission for a certificate that the project is desirable and is justified in the public interest. This application should be followed by a hearing after due notice to the governors of the states through which condemnation rights are asked. If the certificate is granted, the incorporators should be permitted to form a corporation with the usual powers and in addition thereto (subject to the approval of the utility commission of the state where the power is to be exercised) the right to construct, maintain and operate power plants and transmission lines and the right to purchase electrical energy from and sell it to electrical power producing and distributing companies. All of these rights should be subject to the exercise by each state of its full police and taxing power.

It will be observed that herein no new right is created as against any state, except that of taking by eminent domain the location of a transmission line for the transportation of electrical energy in interstate or foreign commerce. Each state retains unimpaired power to fix rates, to determine the character of structures and to lay and collect taxes to the same extent as such authority is exercised over power producing and distributing corporations of its own creation.

Financial

The plan of financing which has been suggested is based on the supposition that the Superpower System is in its very nature an extension of present power supply systems whereby, combining several large plants with present relatively small plants, economy in generation and conservation of natural resources can be secured over that at present attained. Therefore the vested rights of existing public utility power generating and distributing companies should be protected.

Dependence must be placed on the incentive of private initiative to lower costs and on some form of public regulation of prices to the consumer. The power generated and distributed by the Superpower System will finally be distributed to the public by means of existing companies, and the economies to the public utility companies which will result must ultimately be reflected in prices to the consumer through the action of the state regulating bodies.

The financial plan in bare outline provides for a superpower company with non-par stock as its only class of security. The public utilities within the Boston-Washington zone are to be entitled to subscribe for this stock pro rata, based upon capacity demand and load factor, stock not taken by these customers of the Superpower System to be offered to public subscription.

A contract between the superpower company and a local public service company would be a selling contract or a buying contract, while in many cases both buying and selling of electrical energy would be involved. These contracts, on which the state regulatory bodies would pass, would be adjusted from time to time to meet the progress of the art and changing conditions, whether favorable or unfavorable to costs of operation.

Returns upon the stock of the superpower company should be limited by specific provision to a fair division of the benefits derived from its operation between the investing public and the consumers that will make it possible for the superpower company to come into existence and at the same time be able to serve the public adequately. New capital is the keystone of the project, but the public demand is its foundation. This division of benefits would be attained by a rule under which the customer companies shall participate equally with the stockholders in any distribution, at stated intervals, of net earnings in excess of a specified rate of return, which itself should be more liberal than is commonly contained in the idea of public regulation. Thus efficiency in management would be rewarded and the public interest directly served. To secure the participation of the ultimate consumer in this division of benefits, provision should be made that the superpower stock held by any public service company be regarded as representing an extension to its existing station capacity rather than an outside investment security.

Absolute publicity of the superpower company's operations will be an essential condition. Freedom of action should, however, be also sought for this company in order to promote the free flow of capital to this enterprise, whose requirements will be large and continually increasing.

The prime object of the superpower plan is a larger supply of cheaper power. The Superpower Survey looks to the full utilization of all resources, and conservation of the country's fuel cannot be attained except with the aid of large capital investment. Neither the nation, by coal conservation, nor the individual consumer, by lower rates, can profit by the project, however sound in its engineering and economic phases, unless the conditions of financing are sufficiently attractive to warrant the use of the country's financial resources.

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Business Situation of Electrical Industries of Germany and Austria

To the Editor of the ELECTRICAL WORLD:

SIR: Important developments are taking place in Germany's electrical industries which will not be without effect on similar affairs in Austria. Considerable increases in capitalization are being made in Austria. These follow one another rapidly, with a fusing of neighboring and related industries, such as that recently accomplished by the imposing Elektromontankunzern (Electro-mining Artificers). This more closely knit relation between the great electrotechnical firms and their important mining activities on the Rhine and the Elbe has two aims in view. First, it would strengthen the financial basis of the electrotechnical industries. Second, it hopes to provide the foreign complexion, due particularly to American participation, with a domestic counterweight that shall influence both the preferred shares with their multiple voting powers and also more extensive capitalistic interests. On the other hand, the sources of supply of raw materials have been expanded, thus enabling the electrotechnical fabricators to work with their own products all along the line from raw material to finished article.

Of course, the German electrical industries must not curtail their expansion if they are to maintain their world position, and it is a tremendous one to defend. Intimately allied and intertwined as these industries in Germany and Austria are, the latter is of much more modest dimensions; but it also shows no lack of endeavor.

Austria must see to it that her field of trade in the new national states—particularly in Bohemia and Hungary—is not undermined by the active local establishments and that the Near Eastern market is not alienated. So far Austrian firms have successfully maintained their positions. Their activity still continues at an unusually high pitch, maintained chiefly by the large government orders for materials destined for the electrification of the state railways of western Austria (in the Vorarlberg and elsewhere). But private deliveries are also satisfactory.

Electric power companies, however, are suffering some restriction in their financing efforts. Their activities have consisted heretofore in obtaining concessions and building power plants at their own expense, eventually maintaining them by selling power. The recession in the promoting of such installations is primarily due to the efforts of many communities to build their own electric power plants or, in cases where private plants are already in service, to exact penalties from them.

The future of the electrical industries seems to rest particularly in the execution of the water-power projects proposed and now holding first place in the plans for economic reconstruction of Austria is adopted by the Reparations Commission.

S. SILBERSTEIN.

Vienna, Austria.

[This letter was dated Dec. 28, 1920. Before it was received the Austrian government had asked the Allied Powers to take over the administration of its affairs, and on Jan. 25 the United Press reported that the Inter-Allied Supreme Council had appointed a commission to determine what must be done toward the rehabilitation of Austria. No official statement, a Vienna dispatch under date of Feb. 5 asserts, has yet been received as to decisions taken. The policy adopted in the final program of reconstruction toward the movement reported by Mr. Silberstein will be of interest—EDITOR.]

Consumers' Power Company Does Not Think Straight Rates Better than Combination

To the Editor of the ELECTRICAL WORLD:

SIR: The writer's attention has been called to an article in the ELECTRICAL WORLD for Oct. 2, 1920, entitled "Straight Rate Better than Combination, in Opinion of Michigan Company." In this article it is stated that the Consumers' Power Company in its Grand Rapids district has contended that a straight rate is better than a rate based on connected load plus an energy charge, etc. I do not know the source of this information, but it certainly did not come from any officer of the company, for I am sure they all agree with rate-making authorities generally that a rate based on demand or connected load plus a running charge is much better for all concerned. As a matter of fact, that is the basis of virtually all of the rates charged by the Consumers' Power Company throughout the entire Michigan territory.

The rates of the Consumers' Power Company in Grand Rapids have been for some time for lighting purposes as follows: 8 cents per kilowatt-hour per month for the first 30 kw.-hr. used of connected load, 6 cents for the next 30 kw.-hr. and 4 cents for the excess. A few months ago the company asked the city authorities to agree with it on a slight increase and suggested: 9 cents per kilowatt-hour per month for the first 60 kw.-hr. used of connected load, 6 cents for the next 60 kw.-hr. and 5 cents for the excess.

The city authorities did not agree to make all of the changes the company suggested, and the residential rates remain as first stated. The city authorities, however, did give the company permission to charge an 8-cent flat rate per kilowatt-hour for commercial lighting, with an optional rate of $3 net per kilowatt per month plus a current charge as follows: 5 cents net per kilowatt-hour for the first thirty hours' use per month of the active load, 4½ cents net for the next thirty hours' use and 4 cents net for all energy used in excess of sixty hours' use per month of active load.

The city authorities have consented to the company's increasing its power schedules in various ways. I am writing you on this subject simply that you may have a correct understanding of the situation and that you may not by your reports indicate to readers that the Consumers' Power Company's officials are advocating straight rates per kilowatt-hour. Such is not the case, and we believe such rates, generally speaking, are unscientific and not productive of good results.

B. C. COBB,

President Consumers' Power Company.

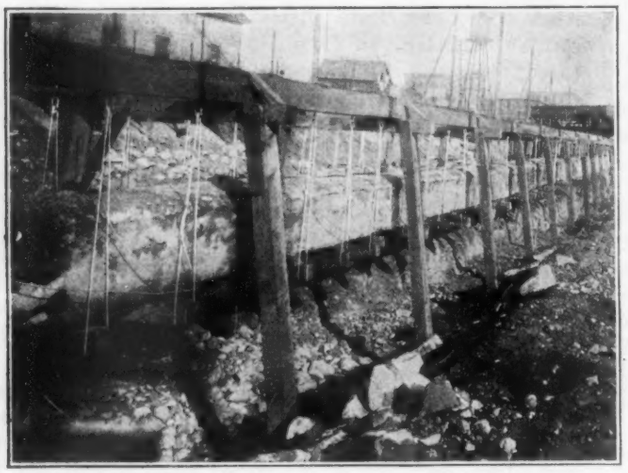
New York City.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Cable Ducts Lowered 12 Ft. Without Service Interruption

TWO underground duct lines containing important feeders were recently lowered 12 ft. in Minneapolis without interrupting service over the cables. The city decided to depress a roadway 12 ft. in order to eliminate a grade crossing, and the central-station company was confronted with the problem of lowering its duct lines. It was at first thought that it would be necessary to take up the old ducts, discontinue the service and put in a new set of ducts after the street had been lowered. It was soon decided, however, that service must be maintained while the change was being made, and instead of tearing up the old ducts they were gradually lowered to the new level without disturbing the cables or the service, and at a cost between $10,000 and $12,000 less than the expense of removing and replacing would have been.



LOWERING DUCTS CARRYING 30,000-KW. LOAD

The street on each side of the ducts was first cut away to the desired level. Then the ground was further cut away under the ducts at points 10 ft. apart and a trestle erected of 6-in. x 6-in. uprights and cross-ties, as shown in the photograph. Two 2-in. x 10-in. planks were stood on edge on top of the trestle 1 in. apart, parallel to the road. The duct line was supported by long ⅝-in. bolts which passed between the two timbers, on top of which was placed a washer and nut for each bolt. Short cross-ties were slipped under the duct 2½ ft. apart, and a loop of ⅜-in. guy wire was passed around each end of a tie and through a pivoted eye on the lower end of the bolt. When all the bolts had been adjusted to take up the tension a scoop shovel was used to take out the remainder of the earth underneath the ducts, leaving them in suspension as shown.

In lowering, the nuts on every other pair of bolts were given three turns. Then the alternate supports were lowered by three turns of the nuts. When the ends of the bolts had been reached the nuts were taken off every other pair of bolts and the guy-wire loops were lengthened out by about the length of the thread on the bolts. The bolts were then put back in position, the nuts screwed down to take up the strain, and the entire process repeated until the ducts reached the new level.

Overhead-line material was used almost exclusively, and with the exception of the short lengths of guy wire and lumber, everything was credited back into stock when the job was completed. The ducts contained eight three-conductor No. 4/0 13,200-volt cables carrying a load of 30,000 kw. There was also one telephone cable. With the exception of the manholes, all of which had to be replaced, the line as now operating on the lower level is the same as the one originally installed on the higher roadway.

S. B. HOOD,
Superintendent of Distribution.
Minneapolis (Minn.) General Electric Company.

Scheme to Determine Whether Distribution Secondaries Are Overloaded

A SCHEME to calculate voltage drop on secondary distribution lines with loads distributed irregularly is embodied in the accompanying table and explanations. Overloaded secondaries may be spotted quickly by using this scheme in conjunction with a map showing secondaries, consumers, transformers and poles.

The table takes as standard a maximum voltage drop of 2 per cent for single-phase lighting circuits with a power factor of 0.95 and a maximum drop of 4 per cent on polyphase circuits with 0.80 power factor. The table is based on the fact that ten consumers or houses one span from a transformer will produce the same voltage drop as five houses two spans away or one house ten spans away. Each house is assumed to take 100 watts and each span is taken as 100 ft. (30 m.). An expression coined for this table is "house span." To get the "house spans" at one pole, multiply the number of houses connected to the pole by the number of spans between that pole and the transformer. The total house spans on a transformer is the sum of those at each pole. If the average span is more than 100 ft., the house spans must be correspondingly increased. Thus in the illustration the sum of the products is 0 + 1 + 0 + 9 + 8 + 10, etc. = 74, and since the average span is

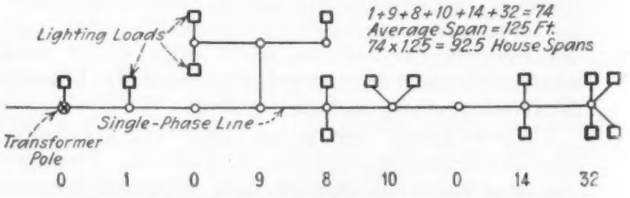


DIAGRAM EXPLAINING METHOD OF CALCULATING SECONDARY VOLTAGE DROP

125 ft., the value 74 must be multiplied by 125/100, giving 92.5 house spans. Turning to the table we find that a No. 5 three-wire or a No. 2/0 two-wire circuit is required. If the wire is actually smaller than this, the voltage drop is more than 2 per cent. If these

TABLES USED TO FIND OVERLOADED SECONDARY CIRCUITS—SINGLE-PHASE LINES

Maximum voltage drop, 2 per cent; power factor, 0.95

Size Wire, No.	Two-Wire, 110 Volts House Spans	Power Loss, Per Cent	Three-Wire, 110-220 Volts House Spans	Power Loss, Per Cent
6	28	2.1	84	2.1
5	34	2.0	102	2.0
4	41	1.9	123	1.9
3	50	1.8	150	1.8
2	61	1.7	183	1.7
1	73	1.7	219	1.7
0	87	1.6	261	1.6
2/0	103	1.5	309	1.5
3/0	118	1.4	354	1.4
4/0	139	1.3	417	1.3
Column	(1)	(2)	(3)	(4)

TWO-PHASE OR THREE-PHASE LINES

Maximum voltage drop, 4 per cent; power factor 0.80

Size Wire, No.	220 Volts H.P. Spans	Power Loss, per Cent	440 Volts H.P. Spans	Power Loss, per Cent
6	39	5.0	156	5.0
5	47	4.7	188	4.7
4	56	4.4	224	4.4
3	66	4.1	264	4.1
2	77	3.8	308	3.8
1	89	3.5	356	3.5
0	102	3.2	408	3.2
2/0	115	2.8	460	2.9
3/0	130	2.6	520	2.6
4/0	144	2.3	576	2.3
Column	(5)	(6)	(7)	(8)

Frequency, 60 cycles. Spacing of conductors per N. E. L. A. standard cross arm.
"House span" (columns 1 and 3) = 100 watts (assumed load for one house a distance of 100 ft. (assumed average length of span).
"H. P. span" (columns 5 and 7) = 1 hp. a distance of 100 ft., assuming 1 kw. load on secondary for 1 hp. output of motor.
Power loss (columns 2, 4, 6 and 8) = loss assuming load all taken at one point for voltage drop of 2 per cent in columns 2 and 4 and of 4 per cent in column 6 and 8.
Capacity of three-wire circuit taken as three times that of two-wire instead of the theoretical four times, to allow for unbalance.

particular houses take 200 watts each, the house spans should be further multiplied by 2.0, thus making 185, and a No. 2 three-wire circuit is required. The "H.P. spans" are used in the same way, substituting the number of horsepower actual load supplied from each pole for the number of houses. The corresponding power loss is given in each case, but the values given are strictly correct only when the load is all supplied from some one pole.

This information was presented by George S. Humphrey, electrical engineer West Penn Power Company, at a recent meeting of the Pennsylvania Electric Association. FIELD EDITOR ELECTRICAL WORLD.

New York, N. Y.

Maintenance of Feed-Water Pumps Prevents Breakdown

THE boiler-feed pump is one of the most vital pieces of equipment in a power plant, and the parts which usually need the most attention are the packing, plungers and valves. If the valves are allowed to become unduly worn and leaky, the pump will jerk and slam from one end of the stroke to the other. Furthermore, the pump will probably have to run about a third faster than normal in order to keep water in the boilers, and that means that one-third more steam is required to do the work. In trying to do its work with leaky valves the pump may also pull the piston rod out of the plunger, break a rocker arm or do damage to other parts of the equipment.

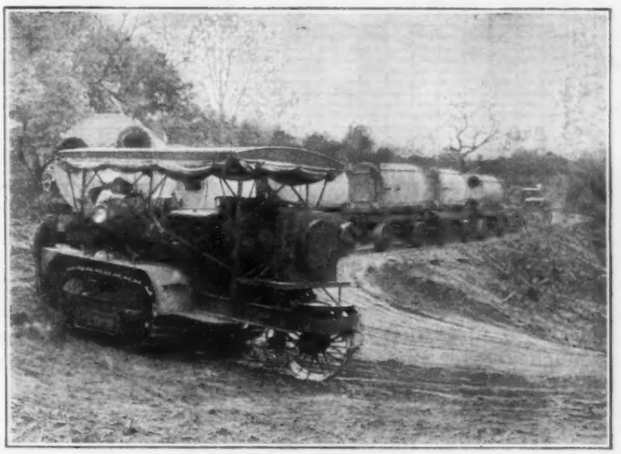
Leaky packing may be caused by uneven wear on the plungers. If the packing is tightened, the pump may force the plungers through it, but the packing will be loose near the middle of the stroke, while at both ends it may be tight enough to stop the pumps or it may break a gland or a stuffing box. These are a few of the troubles that are caused by the neglect of the simple maintenance work of truing up plungers and valves before they cause serious damage. JOHN M. MAY,

Traveling Engineer.

Iowa Railway & Light Company,
Marshalltown, Iowa.

Hauling Transformer Cases on Mountain Roads by Caterpillar Tractor

MUCH of the heavy equipment for the Kerckhoff power house of the San Joaquin Light & Power Corporation (see ELECTRICAL WORLD for Feb. 26, page 471) was hauled over the mountain roads from Auberry



HAULING 5,000-KVA. TRANSFORMERS FOR THE KERCKHOFF PLANT

by means of a 75-hp. Holt caterpillar track-laying tractor and trailers rated at 10 tons and 35 tons. This photograph shows six 10-ton trailers following the tractor around a curve, each trailer carrying a 5,000-kva. transformer. The trailers are of the cross-connected-reach type, so that both axles turn, causing the trailers to track. This train can carry more than 50 tons, and the speed and ease with which it negotiated the steep mountain grades and sharp turns facilitated construction work and reduced the cost of transportation. The maximum grade in this 5½-mile haul was 12 per cent approximately.

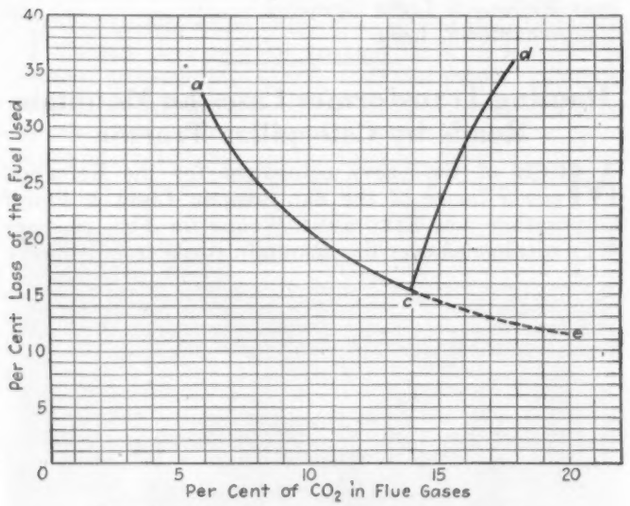
The heaviest piece of equipment hauled weighed 58,000 lb. This was hauled without difficulty on a 35-ton Holt trailer with steel wheels 60 in. in diameter and with 14-in. tread. The haul of 5½ miles was made in four hours, including time for loading and unloading. The total tonnage hauled by this method was 978 tons, of which thirty-nine pieces of machinery ranged in weight from 10 tons to 29 tons each. The average cost of hauling by this method was 13½ cents per mile.

R. C. STARR,
Construction Engineer.

San Joaquin Light & Power Corporation,
Fresno, Cal.

Kinds of Chimney Losses and Their Relative Importance

HEAT is lost up the chimney in two distinct forms, namely, the sensible heat of the entire volume of flue gases and the heat represented by the chemical energy in unconsumed combustible gases. The amount of the sensible heat is a function of the temperature and the volume of the flue gases. The amount of heat lost in the form of chemical energy is a function of the heat of combustion of the unconsumed gases and their volume. The loss of heat represented by a certain percentage of unburned combustible gases in the chimney is much greater than the loss of heat due to excess air represented by an equivalent percentage of CO_2.



FLUE LOSSES WITH VARYING AMOUNT OF CO_2

a-c-e—Ideal conditions; no combustible gases present. *a-c-d*—Practical conditions; combustible gases appear after percentage of CO_2 passes point *c* per cent when air supply is excessive.

To burn fuel completely a surplus of air is necessary over what would be theoretically correct. The amount of this surplus varies constantly, depending upon the many different factors that influence combustion. However, maximum efficiency under practical conditions is attained when there is just enough surplus air to make complete combustion possible, that is, combustion without the escape of combustible gases up the stack. It is at that point that a reduction in the air supply results in an unnecessary waste of energy through the carrying away of sensible heat by excess volumes of flue gases.

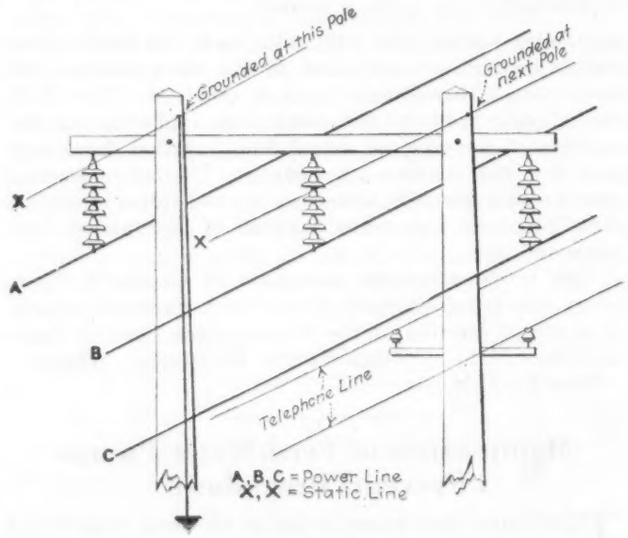
An idea of the magnitude of the fuel losses due to the escape up the stack of combustible gases when the air supply is insufficient, as compared with the losses due to the presence of excess air, may be gained by a comparison of the curves *a-c-e* and *a-c-d*. In *a-c-e* is a curve showing the fuel losses which take place with varying percentages of CO_2 (varying inversely with the excess air supply) in the flue gases, provided there are no combustible gases present. However, combustible gases (CO, CH_4 and H_2) are bound to begin to form at some point as the percentage of CO_2 is increased (air supply decreased), and, as mentioned before, losses due to the formation of these combustible gases are far greater in proportion to their volume than losses indicated by equivalent proportion of CO_2. This is graphically illustrated in *a-c-d*, where the portion *c-d* in the curve represents fuel-heat losses that develop beyond the point *c* where combustible gases begin to form, as the percentage of CO_2 is still further increased by reducing the air supply. The point *c* is the critical point. It is the point where combustion takes place with the greatest economy in fuel consumption. It varies not only in different furnaces, but varies constantly in the same furnace. The curves shown were plotted from generally accepted average values. They show that CO_2 readings alone cannot be depended on.

OLOF RODHE,
Chief Engineer.
Mono Corporation of America,
New York City.

Telephone Noises Reduced by Double Overhead Ground Wire

NOISE on a company telephone line using the same poles as a power line has been considerably reduced by running two grounded wires near the tops of the poles above the transmission line in the manner indicated in the accompanying sketch. The line is operated at 66,000 volts but insulated for 110,000 volts, the construction being of the A-frame type and the poles 400 ft. apart. The "static" wires were run above the crossarm and were grounded at alternate poles.

A probable explanation of the reduction in noise on the telephone line is as follows: The transmission line consists of three conductors equally spaced in a horizontal plane, and the ground wires are installed symmetrically with respect to the transmission line and in a plane above it. The ground wires form a closed circuit every 400 ft., at the points where they are connected to ground. Under no-load conditions there is a voltage induced electrostatically in each ground wire. These voltages are of different phase and consequently cause a current to circulate in the loop formed by the ground wires. The current flowing in this loop is of sufficient duration to neutralize the electrostatic effects of the transmission wires. The effect on the adjacent telephone line is to reduce slightly the amount of voltage induced. Under loaded conditions the effect of the currents in the different wires is to induce electromagnetically a voltage in the ground-wire loop and cause current to flow which reduces the voltage induced by the transmission-line currents.



GROUND WIRES WHICH REDUCE TELEPHONE NOISE

R. H. N. LOCKYER.
West Kootenay Power & Light Company,
Trail, B. C., Canada.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Call System Increases Work of Electric Tractors

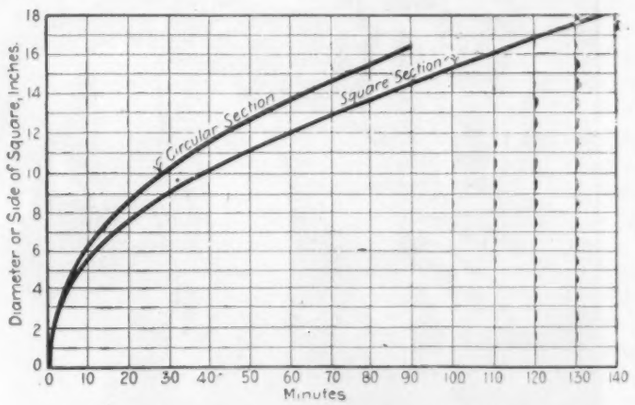
TO KEEP the industrial tractors busy in a plant in Connecticut a twenty-drop annunciator is installed at a central yardmaster's office. Each tractor when idle returns to the office and awaits a call. The numbers on the annunciator correspond to stations in various departments. Sometimes ten or more calls are shown on the annunciator at once. Then the most important departments are attended to first. When one tractor leaves, its call number is chalked on a slate so that the other machines may be sent elsewhere.

A record is kept of all calls. The result of this record soon convinced the firm that one particular department needed a tractor of its own, which was soon procured.

Boston, Mass. S. R. HOWARD.

Castings Cut Economically by Electric Arc Process

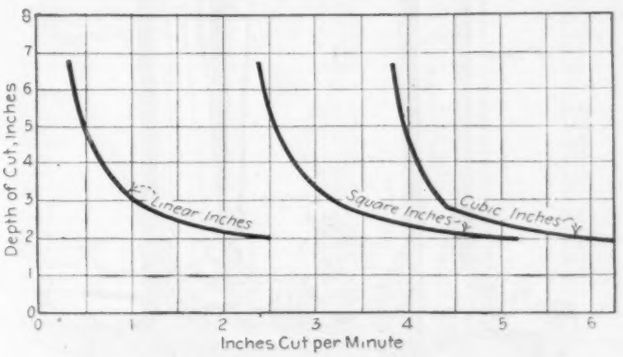
CUTTING steel and iron castings by the electric arc has proved both economical and speedy. In the field of steel castings the arc process is less expensive and as a rule sufficiently accurate and rapid to prove thoroughly satisfactory for cutting off risers and sink heads, and frequently to rectify errors in castings due to mistakes in design or building patterns, such as incorrectly located pads, omitted cores, cored holes that are too small, etc. In the field of gray-iron castings the arc process is much superior from an operating cost standpoint and possibly is faster than the relatively expensive high-pressure gas-cutting devices. The accompanying curves indicate the speed of cutting cast-iron sections using about 600 amp.



TIME REQUIRED TO CUT CAST IRON WITH ELECTRIC ARC

For cutting, the graphite electrode is generally used with current values of from 150 amp. to 800 amp., depending upon the class of work, the speed desired and the capacity of the electrical equipment. For example a ½-in. medium-steel plate can be cut at the rate of about 1 ft. (0.3 m.) in twelve minutes, using 150 amp., or about 1 ft. in about one and one-quarter minutes using 400 amp.

Cutting can be done with the metallic electrode process, employing bare wire or heavily wrapped wire. To use the bare wire it is necessary to operate the electrode



RATE OF CUTTING CAST IRON WITH ELECTRIC ARC

at a much higher current than for welding, which results in scattering the metal and making it difficult for the operator to maintain the arc. The wrapped electrode is undoubtedly better suited for this work, especially if it is dipped in water frequently during the operation. In fact, it is possible to cut with this combination in cases where it is out of the question to use the graphite process. For example, during the war the British navy used water-soaked, heavily wrapped electrodes for cutting holes 2 in. (5 cm.) in diameter and several inches deep in armorplate on battleships for attaching rigging to afford protection against submarine torpedoes.

These remarks were made by A. M. Candy, Westinghouse Electric & Manufacturing Company, at a meeting of the American Foundrymen's Association.

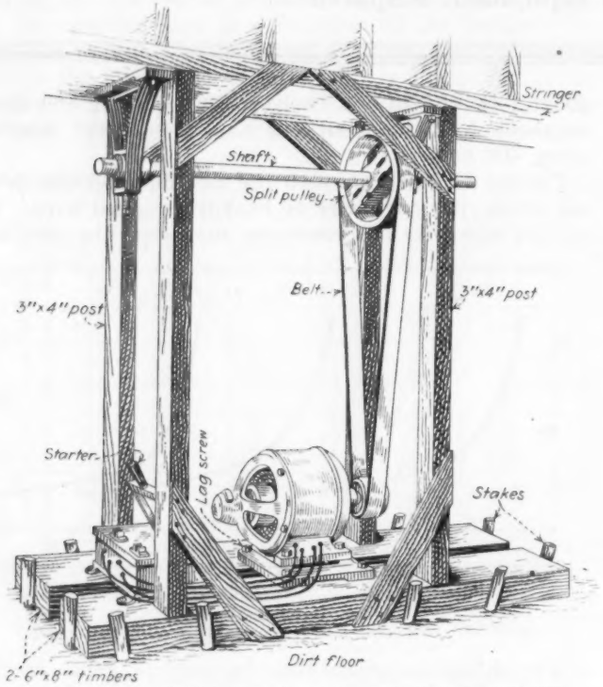
New York, N. Y. FIELD EDITOR ELECTRICAL WORLD.

Emergency Mounting for Motor

A QUICK job in setting up a 50-hp. motor to drive an overhead-line shaft was called for by the breakdown of a steam engine driving the tumbling barrels for cleaning castings in a New England manufacturing plant. This job was accomplished by setting the motor on two heavy timbers as shown in the sketch and bracing these timbers against the roof stringers by means of upright posts.

The tumbling barrels were driven by the engine in an adjoining room, the main shaft being overhead through both rooms. When the engine's piston rod broke, an old type 50-hp. induction motor was hurriedly transported from the stock room. The motor was placed on two 6-in. x 8-in. timbers laid on the dirt floor in a space directly under the shaft, and the timbers were braced under the overhead stringers by 3-in. x 4-in. posts. After leveling the timbers with shims the motor

was secured by four heavy lag screws, a split iron pulley was clamped to the shaft above and a 6-in. belt was hurriedly laced on. A four-wire line directly over the roof, driving the near-by blacksmith shop, was hastily spliced into, and the leads were carried in through an open window to the starting compensator on the floor



MOTOR WAS QUICKLY SET UP ON THESE TIMBERS FOR EMERGENCY USE

and thence to the motor. The bearings were oiled and the direction was tried, and in exactly two hours from the time of the breakdown the tumbling barrels were running again, this time by electric power. All the work was done by two millwrights, an electrician and a belt man.

H. S. RICH.

East Berlin, Conn.

Direct-Current Motors Kept in Synchronism in Paper Mill

DIRECT-CURRENT motors driving paper machines in the mill of the Crown-Willamette Paper Company, West Lynn, Ore., are made to operate at the same relative speeds under varying loads by coupling them with smaller synchronous motors connected in parallel. When the speed of a direct-current motor tends to drop the synchronous motor holds it up.

This drive consists of one unit for each section of the paper machine. Each unit consists of a direct-current motor and a synchronous motor of about 20 per cent of the rating of the direct-current motor, the synchronous motor being coupled with the direct-current motor through a reduction gear and a belt running on a pair of slightly tapered cones, which permit of a total range in speed of 12 per cent. The motors and cones are mounted on a common base and directly connected to one section of the paper machine. All of these synchronous motors are connected to a common bus not tied to any other line. They are excited from an exciter bus. The direct-current motors are all started from one central remote-control panel. The synchronous motors are started at the same time by the belts and gears. Since they are all connected to the same bus they will start and run in synchronism.

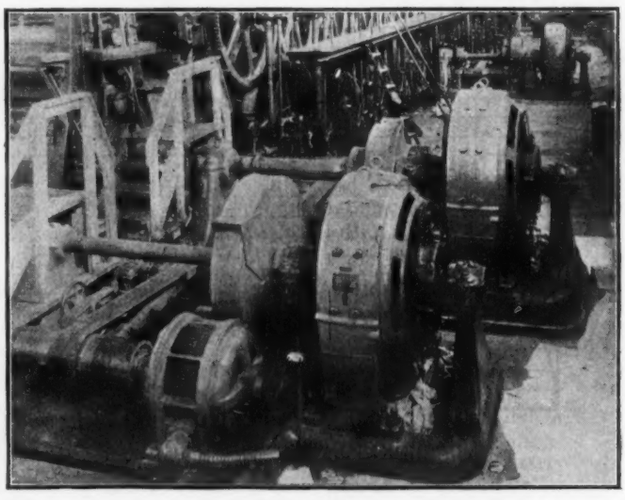
Under actual operation any change in the load on a particular section caused by changing the weights or otherwise altering conditions will be absorbed by the synchronous machine. If the load increases, it will act as a motor on that particular section and draw its power from the remaining synchronous machines, which will immediately act as generators and distribute the load over the entire drive. If the load decreases, the synchronous machine will act as a generator and supply power to the remaining synchronous machines, which then act as motors. Any change in load on any section is therefore distributed over the whole motor equipment and may change the speed of the paper machine as a whole but cannot cause any change in the relative speeds of the various sections.

So long as any synchronous machine operates within its rating either as a motor or as a generator it will not be necessary to make any adjustments, but if the indicating wattmeter in the synchronous machine circuit shows too much power it may be easily brought back to zero by turning the rheostat in the direct-current motor field.

The speeds of the different sections of the paper machine are not all the same. There is a slight increase from the wet end to the dry end, and this difference may vary slightly for different grades of paper and under different operating conditions. This variation is called "draw" and is taken care of by shifting the belts on the cones, which can change only the direct-current-motor speed since the synchronous-motor speed is fixed.

Each direct-current motor has a drum controller and rheostat in its circuit for individual starting, the last point of this controller being in the auxiliary circuit of the contactor which connects the synchronous motor to the dead bus. The actual closing of this contactor is by means of a push-button, but it can only be closed when the controller is on the last point.

The auxiliary-control panel controls the speed of the



SYNCHRONOUS MOTOR IS BELTED TO DIRECT-CURRENT MOTOR AND CONTROLS ITS SPEED

entire paper machine as a unit. When starting as a unit the drum controllers in the direct-current motor circuits should all be on the last point, with the synchronous motors connected to the dead bus. The starting button on the auxiliary panel will close the line

contactor on the motor-generator panel, applying a low voltage to all of the motors and turning them over at a low speed. To bring the machines up to speed the generator field is strengthened by turning the hand wheel on the auxiliary-control panels. This equipment, the first of its kind applied to paper mills, was developed by the General Electric Company.

New York, N. Y. FIELD EDITOR ELECTRICAL WORLD.

How to Clean a Dirty Motor Before Repairing

FOR cleaning a dirty motor before it is turned over to a repairman the writer uses a very effective method. After the end bells are moved and the rotor is taken out sawdust well soaked in gasoline is placed on the coils and laminations and rubbed into the cracks and along the wedges. Then the sawdust is blown out with compressed air, leaving the motor free from grease and dust. In order to protect the man who does this cleaning a helmet was made from a piece of canvas with a copper wire mesh inserted to look through. This keeps the sawdust from the head and neck of the cleaner.

This method of cleaning has been found much better and more economical than using gasoline and waste. In this plant there are more than 200 motors of different types, and these are used in some dirty places, such as blacksmith shops, grinding rooms and foundries. The method works satisfactorily on the dirtiest of the motors.

N. S. DAVIS.

Batavia, N. Y.

Energy and Plant Requirements for Artificial Ice Storage

THE accompanying tabulation gives the power consumption under the various conditions existing month by month for the storage of artificial ice near centers of high summer demand for the purpose of minimizing summer haulage and maintaining a high annual production factor in a few large ice-manufacturing plants. During the months of September, October and November, 1919, there was virtually an empty storage house, and it was possible to eliminate the refrigeration in those compartments of the house which had been emptied. From Sept. 25 to Oct. 13 no refrigeration at all was furnished, except to the lobby, and during that time ice was supplied direct from the main plant to consumers. The low energy consumption during the month of December, 1919, and January, 1920, was caused by low outside temperature, which averaged below the freezing point and necessitated almost no refrigeration.

The energy consumption is almost directly proportional to the total number of heat units admitted to the building and is independent of the amount of ice in storage as long as the temperature of the ice is kept below the melting point. The temperature of the storage space is maintained continuously at from 24 deg. to 27 deg. Fahr. (4.5 deg. to 3 deg. C.), with an estimated average of 26 deg. Fahr. (—3.3 deg. C.). The figures in the accompanying table give an average monthly energy consumption under normal operating and temperature conditions of about 155 kw.-hr. per degree difference between the average inside and average outside temperature. This figure can only be applied, however, to this storage house or to one of identical construction and exposure. It will be noted that more energy is required during both very cold and very hot months, and this is due to different causes.

During the coldest days of the low-temperature months no refrigeration was required, and all of the energy was used for refrigeration on the warm days. The amount of refrigeration was therefore entirely dependent on the difference between 26 deg. and the average temperature of the warm days, and not upon the average of all of the days of the month. An average for the entire month would be lower on account of the effect of the extremely cold days.

ENERGY REQUIRED TO STORE ARTIFICIAL ICE IN ST. LOUIS

Month 1919	Kw.-Hr.	Tons in Storage, Average for Month	Average Daily Outside Temperature, Deg. Fahr.	Kw.-hr.÷ Outside Temperature—26 Deg. Fahr.
January	2,290	3,659	37.8	197x
February	1,800	4,453	36.7	168
March	2,800	4,572	47.1	133
April	4,130	4,586	57.5	131
May	5,760	4,597	63.0	155
June	14,250	4,128	77.3	278x
July	14,480	3,137	81.6	260x
August	9,090	2,130	77.1	178
September	4,890	838	73.6	103x
October	5,070	47	60.8	146
November	3,160	730	44.8	168
December	870	1,648	29.6	242x
1920				
January	760	2,118	28.4	317x
February	1,900	2,822	34.8	216x
March	3,289	3,744	46.6	160
April	4,380	4,320	51.2	173
May	7,570	4,491	64.8	195x
June	13,820	4,386	75.2	280x
July	13,740	3,712	78.8	260
August	10,710	2,778	75.1	218x
September	10,050	2,175	72.5	218
October	5,450	1,528	64.0	143
November	2,980	1,192	43.7	168
December	1,580	1,162	37.5	137

The total of items in the last column not crossed is 1,860, or an average of 155 kw.-hr. per deg. Fahr. difference in temperature.

The high electrical consumption in the hottest month is ascribed almost entirely to the effect of the very frequent opening of the portholes and doors in the storage house. It is during these hot months that ice is unloaded from storage, and there is also a certain replenishing of the supply from the main plant.

The operation of the plant in summer requires a day and a night operator, each of whom, besides operating the mechanical equipment, can give a great part of his time to handling ice on the platform. However, one or more additional men are required within the storage in periods of storing and emptying. In the winter time one man operates the plant and fulfills all platform duties.

The average operation during the months of June and July requires between twenty-four and thirty-six hours of 11-ton compressor operation. This is usually accomplished by operating one compressor continuously and using the second machine during the daytime or the period of maximum outside temperature.

The ice-storage house, which is exposed on all sides, has outside dimensions of 68 ft. x 78 ft. and is 40 ft. high. It contains about 210,000 cu.ft. of space and has a capacity of 4,600 tons of ice. The building is constructed of buttressed brick walls, steel and frame partitions dividing the storage into three rooms. It has a frame and composition roof and is without any attic. The floor and all walls are insulated with 4 in. of impregnated cork board, and the ceiling is insulated with 5 in. of the same material. Adjoining the storage house on one side is a one-story brick engine room and lobby with a composition roof.

The necessary refrigerating plant consists of two

York vertical inclosed compressors of 11 tons refrigerating capacity, each driven through a leather belt by a 20-hp., 865-r.p.m., 220-volt, three-phase, 60-cycle, wound-rotor-type motor. A 7½-hp., 1,140-r.p.m., 220-volt, three-phase, 60-cycle squirrel-cage motor is belted to a 22-cu.ft. air compressor which operates three Curtis automatic elevating and lowering machines, each of which will handle 400 lb. of ice. The storage space is equipped with about 13,000 ft. of 2-in. direct-expansion piping so arranged that each of the three compartments can be operated separately.

All the expansion valves are in the lobby to facilitate temperature control by the attendant.

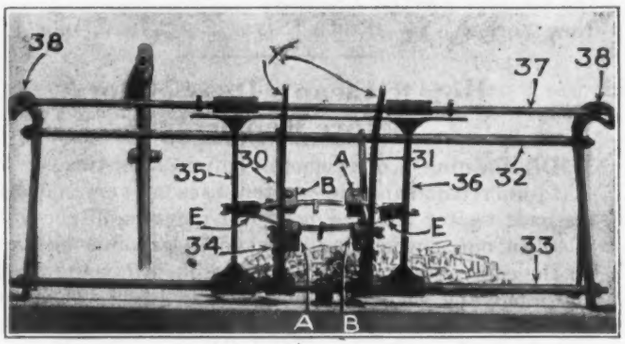
Chicago, Ill. FIELD EDITOR ELECTRICAL WORLD.

Adjustable Home-Made Coil Puller

A COIL puller designed to take all sizes of coils up to the maximum used for wire-wound coils, for open or semi-closed slots, was recently made in the repair shop of a large textile company. A coil shaped by this machine has the same form as one that was wound directly in the slots or on a former the exact shape of a coil. It has the further advantages of being adjustable to all sizes, being quick in operation and being usable by unskilled labor. It consists essentially of two clamps which hold one side of the coil and two other clamps on a pivoted arm which pull out the other side of the coil. The ends of the coil are formed at the same time by means of two clamps on another swinging arm.

As may be seen from the photograph and the front elevation of the drawings, the uprights 30 and 31 which hold the stationary clamps are adjustable along the upper rod 32 and the lower rod 33 to suit the length of the straight portion of the coil. This length is taken as the length of the core plus 1 in. or 1½ in. to allow for clearance on each side of the slot. After the length of the coil is set the approximate pole pitch is measured. If the distance between the slots in which the two sides of the coil must lie is 7 in., the uprights *XX* are opened up to a distance of 7 in. measured between the stationary clamps and the clamps on the uprights *XX*. This is best seen by examining drawing "section *CC*."

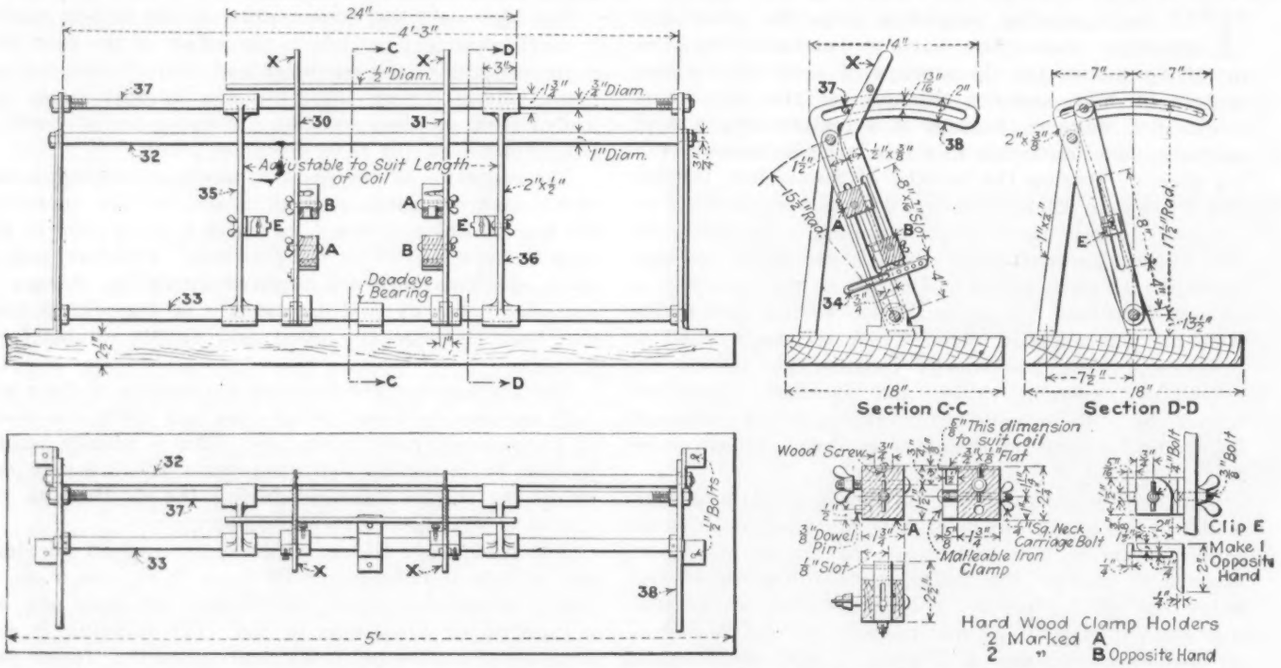
A trial coil is now placed in the clamps *AB*, so that the ends of the coil are on the right-hand side. Now the sliding members 35 and 36 are adjusted along the upper rod 37 and the lower rod 33, so that the clamps *EE* grip the coil at the ends as shown in the photograph. In this position it will be seen that the top half of the coil is held by clamps on the fixed uprights 30 and 31 and the bottom half is held by clamps on the movable uprights *XX*.



THIS SHOWS HOW THE COILS ARE CLAMPED ON TO THE STATIONARY AND THE MOVABLE UPRIGHT PIECES

In order that the coil may not be pulled open more than 7 in., there is a slotted bar, as shown in section *CC*, indicated by 34, and this bar is adjustable by means of a bolt to limit the distance that the arm *X* may be pulled out.

The coil is now pulled out to this limit by pulling on the crosspiece connecting the uprights *XX*. As these pieces are being pulled out the ends of the coil in the clamps *EE* have been drawn in toward each other as the pieces 35 and 36 slide on the rods 33 and 37. At the same time these ends of the coil have followed an arc as the pieces 35 and 36 pivot around the rod 33.



COIL PULLER USED FOR SHAPING COILS FOR PRACTICALLY ALL SIZES OF MOTORS

In order that the radius of the coil might be the same as that of the stator or rotor in which the coil is to be placed, the clamps *A* and *B* were positioned at a distance above the rod 33, so that the bottom of the coil held in the movable clamps on the arm *X* is the same distance from the center of the rod 33 as the distance from the center of the motor to the bottom of the slot if a rotor is being wound, or the distance from the center of the motor to the top of the slot if a stator is being wound.

After the coil is removed, if it does not fit the slot properly, either the angles are wrong or the pole pitch is of the wrong length. This is corrected by adjusting the clamps *A* and *B* up or down the uprights and changing the setting of the limiter 34. By adjusting the clamps *A* and *B* the angle of the coil is altered, and by changing the setting of the limiter 34, the throw is changed.

This outfit has proved to do very quick work, as a set of 108 coils for a 100-hp. motor was recently pulled in 2½ hours. The approximate cost of making the puller in January, 1921, was $45. L. E. WOOD.

Airedale Electrical & Manufacturing Company,
Bradford, Scotland.

Preventing Motor Burnouts Caused by Low-Voltage Trip Sticking

STICKING of the no-voltage trip coil of a compensator has often caused the motor connected to the compensator to be burned out. When the motor circuit goes dead on account of line trouble or is opened by a switch this relay should trip the compensator. If it does not, full voltage will be put on the motor when the line is made live again, which will damage the motor and may strip gears or shaft keys.

This tripping is dependent on the dropping of the solenoid core, which operates the latch and thus trips the compensator. The core is apt to stick and prevent the release of the compensator. This sticking of the core may be due to residual magnetism in the cast-iron case which incloses the solenoid and serves as a stop for the core on its up stroke, or it may be due to a mechanical cause such as corrosion of the various parts, projecting points on the laminations, etc.

A correction for the effect of residual magnetism can sometimes be found by changing the case which surrounds the solenoid or by changing the core and getting one which has a short-circuiting copper loop inserted in the top of the core. Some of the newer-type compensators do not have this copper loop in the solenoid core. The mechanical sources of trouble can often be corrected by removing the core and filing it carefully and thoroughly cleaning off the top of the case against which the core strikes. There is sometimes a slight stickiness at this point of contact, which also is a partial cause for the non-release of the core. The tripping latches should be cleaned thoroughly, removing all traces of rust, dirt, etc. The tripping mechanism should be very positive in action and should trip the compensator instantly on the release of the core.

A snap switch in the circuit which goes to the solenoid will allow the motor to be stopped by breaking the circuit and may be used to test the operating condition of the releasing mechanism. If the motor is stopped by tripping the latch with the finger, the test is not so accurate as when the solenoid core falls by the simple expedient of breaking the circuit. Operators should be instructed always to stop the motor by this method, and even if the motor is continuously operated twenty-four hours a day, the test should be made and the motor again started. This will assure that the tripping mechanism will work at a time of emergency.

It is well to test the overload relay coils occasionally to see what current will cause the compensator to open the motor circuit. This may be accomplished by sending current from a 110-volt line through the coils in series with a lamp bank. The current should be increased gradually until the plungers rise. An ammeter in the circuit will measure the current. If current transformers are used, the current must be sent through the relay coils and not through the line feeding the motor. In this case the ratio of motor current to relay current must be obtained from the nameplate of the current transformer. ROBERT HAMILTON.

Brooklyn, N. Y.

Support for Providing Adjustable Local Lighting

AN EASILY assembled lamp and reflector, which is useful for lighting some particular spot where work is being done, has been made out of a vertical telescoping pipe supporting a horizontal pipe which carries a lamp and reflector, as shown in the accompanying illustration. The lamp can be placed at any working height and at any horizontal location within the radius of the top arm. The fixture does not interfere with the operator in any way. An important feature is that the conduit is placed beneath the floor so that the working space overhead is clear of wiring.

The vertical member is made of a pipe firmly fastened in the floor. Into this a slightly smaller pipe is inserted. The second pipe is held in position by means of two nuts in the first pipe, the wing nuts being 90 deg. apart. At the top of the sliding pipe is a "T" holding a cross-pipe which slides in the "T" and which is also held in position by means of a wing nut. At the outer end of the horizontal piece is a conduit through which the lamp cord is run. At the lower end the lamp cord passes into a small conduit rising out of the floor. This arrangement gives two adjustments, vertical and lateral, in addition to a swing. Several modifications of the idea have been developed, some using a 4-ft. (1.2-m.) length of flexible-steel armored tube, instead of the horizontal pipe support. SAMUEL G. HIBBEN,

THE LAMP MAY BE MOVED CLOSE TO THE WORK

Consulting Illuminating Engineer.
Westinghouse Lamp Company,
Bloomfield, N. J.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Manufacturers Co-operate to Build Good Will for Electric Utilities

A COMMON interest has brought the electrical industry together in the past few months as never before. Public confidence must reside in the electric light and power utilities if they are to go forward healthily. In other words, the utilities must have friends. It is not a new idea, but it is refreshing to find the rest of the electrical industry spending its money, and lots of it, to promote utility good will.

Although business is dull and manufacturers are finding it necessary to curtail almost everywhere, still they have sufficient breadth of vision to appropriate advertising space valued in excess of a quarter of a million dollars to make friends for the electric light and power companies. National magazines, the technical press, newspapers, folders—all are being used in some way to tell effectively the good-will story. This campaign is being directed by the National Electric Light Association as the major part of its national good-will program. A committee of manufacturers headed by P. L. Thomson of the Western Electric Company has undertaken to sell the co-operative advertising idea to the electrical manufacturers. So far this committee has met with a very gratifying response. It had an ambitious program to secure from the manufacturers pledges for one-twelfth of their 1921 contracted advertising space. The committee has been working only a short while, and already it has had promises of space from a very large number of companies.

As a background for the advertising by the manufacturers the N. E. L. A. is running through the year in the *Saturday Evening Post* a series of thirteen half pages in which the public is taken into the confidence of the electric utility and made to understand synthetically the unconscious reliance that the individual places on the utility. Three pieces of this copy are shown on this page, the first of which, that on the extreme left, appeared Feb. 19.

Who are You?
NINETY-NINE chances out of a hundred you are the man whose second finger on the right hand is expert in pressing electric buttons.
NATIONAL ELECTRIC LIGHT ASSOCIATION
The Street of Happy Lamps
NATIONAL ELECTRIC LIGHT ASSOCIATION
Energy
NATIONAL ELECTRIC LIGHT ASSOCIATION

THE FIRST THREE HALF-PAGE ADVERTISEMENTS OF THE N. E. L. A.

Large poster reproductions of the N. E. L. A. advertising are being made up on heavy paper, 15 x 22 in., for use by electric light and power companies in their windows. The association is also making up its advertisements in two-column newspaper matrices for local reproduction.

Co-operation, also, has been pledged and is being manifest from the publishers both of general magazines and of the technical press who appreciate the fundamental relation of the electric utilities to the every-day life of the public. In addition to publication advertising, some of the manufacturers are going one step further and are educating their employees through house organs so that they may be boosters for electric service. Still another form of co-operation in this movement is the insertion of good-will messages in the packages containing goods so put up. This plan is being worked out by the Edison Electric Appliance Company. Many of the utilities are using the national advertising locally, either as it is or by adapting it to their own uses, in newspapers and on posters. The cumulative effect of such advertising must naturally be extremely fruitful of results. George F. Oxley, under whose direction this campaign is being conducted from N. E. L. A. headquarters, says that the local co-operation with the national campaign is very gratifying. He has estimated that the total value of fall advertising space, both local and national, used in this effort will approximate a million dollars.

The following companies have agreed to tell the story of good-will in national magazines: General Electric Company, *Saturday Evening Post*; Westinghouse Electric & Manufacturing Company, *Saturday Evening Post* and *Literary Digest*; Western Electric Company, *Literary Digest* and *Collier's*; Wagner Electric Manufacturing Company, *Literary Digest*; Mazda Research Laboratories, *American Magazine*; McGraw-Hill Company, *Collier's*; the American Electrical Heater Company, Edison Electric Appliance Company, Habirshaw Electric Cable Company and Duplexalite Company have not yet designated the magazines which they will use.

—but the ugly little duckling grew up to be a swan
Western Electric Company
Your Electric Light and Power Company Produces and Distributes Community Current
For Light
For Heat
For Power
For Service
—and It's on the Job Twenty-four Hours Every Day
estinghouse
COMPLETE EQUIPMENT FOR CENTRAL STATIONS
SERVICE TO YOU
GENERAL ELECTRIC COMPANY

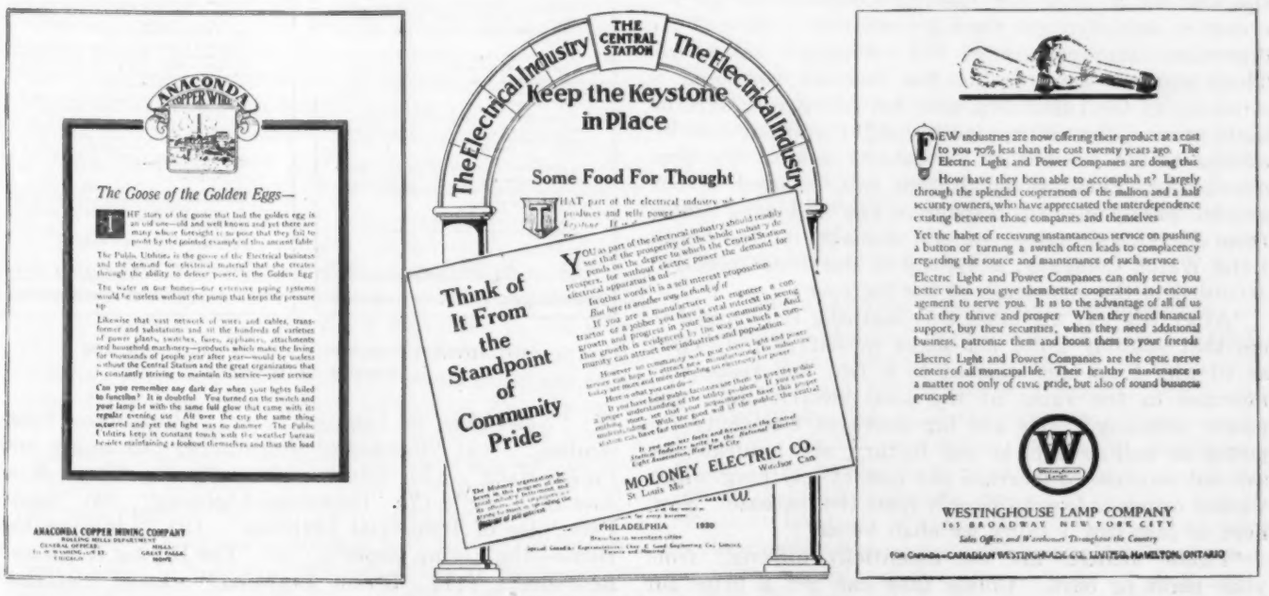
MANUFACTURERS' NATIONAL MAGAZINE ADVERTISING
A Westinghouse two-page spread and a General Electric page, both in the *Saturday Evening Post*, and one of the Western Electric good-will series.

Two companies, Robbins & Myers and the McGraw-Hill Company, have decided to do newspaper advertising, the former in twenty-three and the latter in twenty principal cities.

The list of those who have pledged space in the technical journals is, of course, much larger and includes the following: Trumbull Electric Manufacturing Company, Plainville, Conn.; Hygrade Lamp Company, Salem, Mass.; Condit Electrical Manufacturing Company, South Boston, Mass.; Kuhlman Electric Company, Bay City, Mich.; ELECTRICAL WORLD; Burke Electric Company, Erie, Pa.; Electric Storage Battery Company, Philadelphia; Majestic Electric Development Company, Philadelphia; Locomotive Electric Washing Machine Company, Belleville, Ill.; *Electrical Review;* Federal Electric Company, Chicago; Sangamo Electric Company, Springfield, Ill.; Moloney Electric Company, St. Louis; Roller-Smith Company, New York City, *Electric Journal*; Power Specialty Company, New York City; Westinghouse Lamp Company, New York City; Packard Electric Company, Chicago; Sangamo Electric Company, house Company, Ltd., Hamilton, Ont., Canada; *Central Station*; Hamilton-Beach Manufacturing Company, Racine, Wis.; Syracuse Washing Machine Corporation, Syracuse, N. Y.; Britton & Doyle, Cleveland; Jeffery-Dewitt Insulator Company, Huntington, W. Va.; P. A. Geier Company, Cleveland; Anaconda Copper Mining Company, Chicago; Domestic Electric Company, Cleveland.

Reproductions of advertisements that have appeared in the national magazines, newspapers and technical press, as shown in these pages, are typical of the spirit of broad-minded enthusiasm with which the electrical manufacturers are helping the electric light and power companies to build good will.

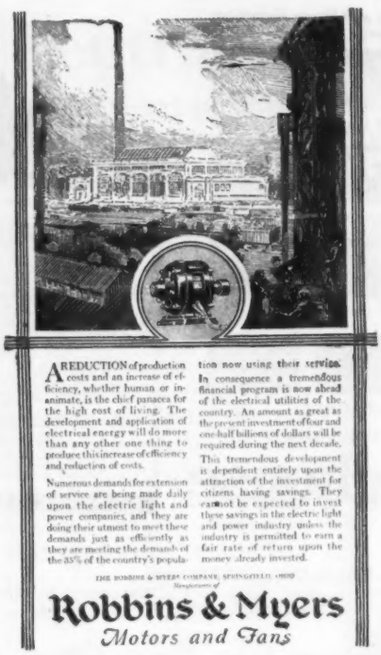
The co-operative campaign of the manufacturers ties in with the booklet good-will advertising prepared by the N. E. L. A. for distribution locally by the electric light


ANACONDA COPPER WIRE
The Goose of the Golden Eggs—
ANACONDA COPPER MINING COMPANY
The Electrical Industry
THE CENTRAL STATION
The Electrical Industry
Keep the Keystone in Place
Some Food For Thought
Think of It From the Standpoint of Community Pride
MOLONEY ELECTRIC CO.
St. Louis Mo.
PHILADELPHIA 1920
FEW industries are now offering their product at a cost to you 70% less than the cost twenty years ago. The Electric Light and Power Companies are doing this.
How have they been able to accomplish it? Largely through the splendid cooperation of the million and a half security owners, who have appreciated the interdependence existing between those companies and themselves.
Yet the habit of receiving instantaneous service on pushing a button or turning a switch often leads to complacency regarding the source and maintenance of such service.
Electric Light and Power Companies can only serve you better when you give them better cooperation and encouragement to serve you. It is to the advantage of all of us that they thrive and prosper. When they need financial support, buy their securities, when they need additional business, patronize them and boost them to your friends.
Electric Light and Power Companies are the optic nerve centers of all municipal life. Their healthy maintenance is a matter not only of civic pride, but also of sound business principle.
WESTINGHOUSE LAMP COMPANY
165 BROADWAY NEW YORK CITY
Sales Offices and Warehouses Throughout the Country
FOR CANADA—CANADIAN WESTINGHOUSE CO. LIMITED, HAMILTON, ONTARIO

TYPICAL TECHNICAL PUBLICATION ADVERTISEMENTS
Anaconda Wire, Electric Storage Battery, Moloney Electric and Westinghouse Lamp early joined the movement.

and power companies. At the last count orders for around seven millions of booklets had been placed. It is planned that users of electric service will receive good-will literature at frequent intervals. These activities, together with the work of the state committee on public utility information, promise a better understanding on the part of the public of the electric light and power utility and its problems.

While it is true that the utilities, manufacturers, technical press and all in the industry will benefit proportionately to success of the campaign, still those who are conducting it are careful to impress on everybody that in the last analysis it is the public that will have the most lasting benefit through the greater and better service that will come by reason of the greater ease in financing made possible by a better understanding of the fundamental strength of electric light and power companies.


A REDUCTION of production costs and an increase of efficiency, whether human or inanimate, is the chief panacea for the high cost of living. The development and application of electrical energy will do more than any other one thing to produce this increase of efficiency and reduction of costs.
Numerous demands for extension of service are being made daily upon the electric light and power companies, and they are doing their utmost to meet these demands just as efficiently as they are meeting the demands of the 85% of the country's population now using their service.
In consequence a tremendous financial program is now ahead of the electrical utilities of the country. An amount as great as the present investment of four and one-half billions of dollars will be required during the next decade.
This tremendous development is dependent entirely upon the attraction of the investment for citizens having savings. They cannot be expected to invest these savings in the electric light and power industry unless the industry is permitted to earn a fair rate of return upon the money already invested.
THE ROBBINS & MYERS COMPANY, SPRINGFIELD, OHIO
Manufacturers of
Robbins & Myers
Motors and Fans

One of the newspaper advertisements, Robbins & Myers will run in the papers of twenty-three cities

Public Sentiment Squelches Opposition to Rate Increase

FURTHER encouraging evidence of a better understanding by the public of the problems of the public utilitiy companies came to light recently in South Bend, Ind. Application to the Public Utility Commission by the Indiana & Michigan Electric Company for an increase in rates brought forth a considerable show of indignation from certain of the company's customers. Those opposed to granting the increase composed a minority of the customers, and, not being very sure of their ground, they attempted to bolster up their case by adding to the number of protestants against the proposed rate. Personal solicitation was resorted to but gained practically no response. The following letter from F. H. Wellington, general manager of the South Bend Watch Company, is typical of the usual reception accorded to the opponents of the increase:

"After you left my office this morning it occurred to me that possibly I did not make myself entirely clear as to why I am not opposed to a just and reasonable increase in the rates of the local electric light and power company. We are big users of electricity for power as well as light in our factory, and naturally we are not anxious to increase the cost of anything which we buy or use unless we benefit from the increase. Now, here is just how I think we shall benefit:

"Public utilities are not essentially different from your plant or ours. Unless they can get a price for their product that will bring them a fair return on their investment they must naturally let their plant and their service deteriorate, and might eventually even be forced temporarily to suspend operation. Such a result would greatly inconvenience all users of their service.

"You and I know how our costs have gone up during the past two or three years. We are not selling our goods for the same prices which prevailed before the war. We couldn't do it and continue to operate. Then why should we expect the light and power company to do the impossible?

"As manufacturers of high-grade watches distributed through more than 12,000 jewelers in the United States, we feel a responsibility to this big army of dealers in keeping our plant moving at a pace that will keep up with the demand for South Bend watches. From both their standpoint and ours, it seems to us that it would be a penny-wise and pound-foolish policy to try to save a few cents on our power cost and run the chance of ultimately getting poorer service or none at all. We are not in any way financially interested in the Indiana & Michigan Electric Company, but do believe in treating it, as well as all of our other business associates, fairly.

"Think it over and see if the same thing does not apply to your own business in much the same way."

Educational Campaign for Better Lighting

TO IMPROVE the general standard of lighting the British Columbia Electric Railway Company of Vancouver, B. C., recently conducted an educational advertising campaign. A series of eleven advertisements, beginning with the elementary ideas on lighting, has just been completed in the newspapers. Two of the advertisements, the third and seventh to appear, are shown here. The series was entitled "Modern Lighting Developments" and included the following subjects:

Modern Lighting Developments
Article No. 7.
Industrial Lighting and "Overhead" Reduction
TESTS made under most critical inspection show that production has been increased as much as 10 to 30 per cent. by proper factory illumination.
Spoilage has been reduced 25 per cent by the same means: quality has been improved; workmen have obtained better working conditions, and accidents have been greatly reduced.
The low cost of current today makes it well worth while to increase the efficiency of factory lighting by having it properly designed, by having the proper intensity for the class of work and by installing the type of lighting best fitted for your requirements.
Industrial lighting has been given official recognition in numerous states south of the line and factories have been required to bring their lighting up to certain standards fixed by law.
It is not possible to reprint the long schedules of lighting as applied to various industries, but we suggest that industries obtain expert advice, for which they will be well repaid in increased profits.
The next article will be on "Some Principles of Factory Lighting," and will appear in this paper on Monday
B.C. Electric
SERVICE

Beware of Glare
Eye Under Strain
Normal Eye
THE glare which intensely bright headlights on an automobile produce is just as dangerous when produced by a less intense light if sustained over a long period.
A glance at the sun proves that any extremely bright light coming within the field of vision is capable of producing acute discomfort.
In auditoriums, churches, public halls, etc., care should be taken to avoid any direct rays of light falling upon the eyes of the audience, otherwise, fatigue will result and the effect of speakers will be lost.
The position of lights and the design of fixtures are important factors in the elimination of glare but attention should also be given to color of walls, intrinsic brilliancy, distance, etc. The use of frosted globes is often desirable if indirect illumination is not used.
The reflecting properties of materials and of walls must be attended to. For a machine shop, more diffused light sources must be used than for a wood-working shop owing to the reflection from metal. Bright walls may produce discomfort unless the light is projected upon horizontal surfaces only. Walls finished in buff, light green or gray reflect about the proper proportion of light. Walls finished in high gloss are not satisfactory from a glare standpoint.
These questions are important in offices and industrial establishments where fatigue has a great bearing upon production. An expert should be employed in every case to lay out the illumination.
The next article will be on "Churches and Public Halls" and will appear in this paper on Monday
B.C. Electric
SERVICE

TWO ADVERTISEMENTS USED IN CAMPAIGN FOR BETTER LIGHTING

(1) "New Ideas on Lighting"; (2) "How Many Foot-candles?"; (3) "Beware of Glare"; (4) "Churches and Public Halls"; (5) "Store Lighting"; (6) "Show-Window Lighting"; (7) "Industrial Lighting"; (8) "Some Principles of Industrial Lighting"; (9) "Lighting the Home—the Living Room"; (10) "The Dining Room and Bedroom"; (11) "Street Lighting." Local electrical contractors were circularized and urged to clip out the advertisements and follow them up individually.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Motors, Generators and Transformers

Dimensioning of Auto-Transformers and Booster Transformers.—F. HORSCHITZ.—Simple formulas are derived to give the best design of autotransformers, neglecting core loss and leakage flux. Electrically a booster transformer is identical with an auto-transformer, so that the same formulas may be used for both.—*Elektrotechnik und Maschinenbau*, Jan. 2, 1921.

Commutator Brushes for Synchronous Converters—R. H. NEWTON.—The electrical properties which must be taken into consideration in selecting brushes are that the brush must have sufficient resistance to limit short-circuit currents during commutation and must also have sufficient current-carrying capacity to prevent overheating. From the mechanical standpoint, the peripheral speed of the commutator angle of the brush-holder and whether commutator mica is undercut are the important factors. Generally speaking, the hard or carbon brushes have abrasive or scouring action on commutators, while the softer graphite grades lubricate and give the commutator a good polish. Proper methods of staggering brushes to prevent cutting of the commutator are illustrated.—*Electric Journal*, February, 1921.

Lamps and Lighting

Recent Applications of Color in Lighting.—AUGUSTUS D. CURTIS and J. L. STAIR.—The authors emphasize the importance of color from an artistic standpoint in home lighting, and some interesting applications are given to theater and stage lighting effects.—*Transactions I. E. S.*, Dec. 30, 1920.

Generation, Transmission and Distribution

Short-Circuit Currents in Large Installations.—A. DALLA VERDE.—The phenomena arising in single-phase and polyphase circuits when a short circuit takes place are analyzed and reviewed in this article, and simple formulas allowing the rapid determination of the intensities of the short-circuit currents are derived. Numerical examples are given.—*Science Abstracts, Section B*, Dec. 30, 1920. (Abstracted from *Elettrotecnica*, Aug. 15, 1920.)

Electrically Heated Boilers.—Electrically heated boilers for use on high-tension supply systems up to 8,000 volts, as built by a British manufacturer, are described in this article. Electrodes are immersed in the water and the currents pass directly through the water for heating purposes. It is said that experiments are under way for use of these boilers directly on voltages up to 15,000. Their use is especially advocated for making use of hydro-electric energy over Saturday and Sunday, when there is usually an excess of water power available.—London *Electrical Times*, Dec. 23, 1920.

Forward Steps in California Hydro-Electric Designs.—In California alone there are thirteen hydro-electric developments now under way, of which all but two are to be in service by January, 1922, developing a total of 522,600 hp. Several important installations are being or are soon to be made, including the 40,000-hp. single-runner units for the Fall River plant, the reaction turbines to operate under a head of 806 ft. (245 m.) at Kern River plant No. 3, and the 220,000-volt transmission system from the Pit River plant to San Francisco. A table gives the principal characteristics of these thirteen developments.—*Engineering News-Record*, Dec. 30, 1920.

Traction

Progress of the One-Man Safety Car.—HARRY L. BROWN.—A general treatise reviewing the advent of the light-weight one-man safety car, giving the economic aspects of design and utilization and the economies which have been obtained.—*Electric Railway Journal*, Jan. 22, 1921.

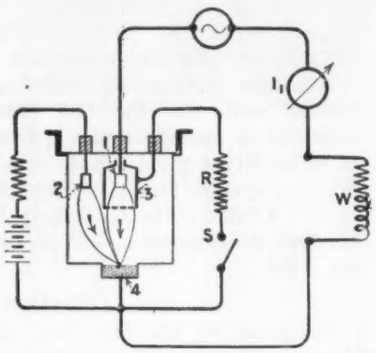
Electric Traction on the Berlin Railways.—WECHMANN.—After preliminary work extending over a period of several years the Berlin Railway Commission has now started actual work on the electrification of the suburban lines between Berlin and Bernau and Berlin and Hermsdorf. Single-phase alternating-current transmission at 15,000 volts and 16⅔ cycles has been chosen. The power will be supplied for the present as three-phase current, converted into single-phase from one power station. The trolley wire will be catenary, suspended on towers 100 m. apart. The trains will consist of twelve passenger coaches and one power truck at each end. The motorman will be stationed at the front of the first coach, being able to look forward over the low power truck ahead of him. The advantages claimed for this system as compared with locomotives or motor cars are its lower weight, the high-placed and well-sprung motors, the higher efficiency of larger motors and cheapness. The disadvantages of slow acceleration (only 0.28 m. per second per second) with such power trucks is overlooked, as they are sufficiently fast for suburban traffic. Later, for the urban lines of Berlin, the two power trucks may be replaced by locomotives. Before the war the program (suburban lines only) could have been finished in one and one-half years, but it is uncertain how much longer it will take now.—*Elektrotechnische Zeitschrift.*

Installations, Systems and Appliances

Radiology Applied to the Testing of Materials.—A. P. M. FLEMING and J. R. CLARKE.—In the first part of this article a description of apparatus and a theory for the production of X-ray suitable for the examination of metals for ascertaining structural soundness are given. The second part contains general specifications for an X-ray installation, assuming that an induction coil is to be used. Future possibilities and usefulness in the examination of materials are said to be dependent on improvements of (a) the methods of production of X-ray, (b) the manner in which the effect of X-rays

can be appreciated by our senses, and (c) technique.—London *Engineering*, Dec. 24, 1920.

Relay for Strong Currents.—This relay utilizes mercury vapor and resembles a three-electrode valve. The figure shows the diagram of the apparatus and its connections: 1 is an iron anode, 4 a mercury cathode, 2 an auxiliary iron cathode and 3 the control electrode. These electrodes are contained in a metal case, which is then exhausted. The alternator is connected to the anode 1 and to the cathode 4 through the load *W*. During one half period the current passes through 1 and 4; during the successive half period the current is interrupted, but the current from the battery maintains the apparatus in activity. A single apparatus will therefore furnish a pulsating current, and two such devices, suitably connected, will furnish ordinary alternating current; but if the switch *S* is closed the current is immediately broken. This apparatus allows currents as large as several hundreds of amperes to be broken. The same apparatus suitably used can transform into oscillatory current the direct current furnished by the battery. Utilizing a battery giving 100 volts, this apparatus was capable of furnishing an oscillatory current of 40 amp.—*Science Abstracts*, July 31, 1920. (Abstracted from *Elettrotecnica*, May 15, 1920.)



DEPENDENCE OF SPARK VOLTAGE ON AIR PRESSURE

Electrophysics and Magnetism

Method for Determining the Fundamental and the Harmonics of an Alternating Current.—L. LOMBARDI.—This method, which is a development of the Joubert contact method, allows of the obtaining of either the resultant curve or, separately, the harmonics of an alternating-current curve. It is founded upon the fact that if the number of contacts is two or more per period the fundamental frequency gives zero deflection in the galvanometer. By employing an interrupter giving a number of contacts per turn equal to the number of periods of a given harmonic, only the current generated by this harmonic flows through the galvanometer. The apparatus utilizing this method consists, in the case of multipolar alternators, of a disk which can be put into motion by holding a point against the end of the shaft of the alternator, as an ordinary revolution counter, the disk being provided with 3, 5, 7, etc., contacts for alternators with 1, 2, 4, 8, etc., pairs of poles. Separate metallic stars with 3, 5, 7, etc., points allow of using 3, 5, 7, etc., contacts per turn. A metallic brush, which can be fixed in different angular positions, allows of different points of the resultant curve or of the different harmonics being obtained.—*Science Abstracts, Section B*, Nov. 30, 1920. (Abstracted from *Accad. Sci. Torino, Atti 55, No. 15*, 1920.)

Positive and Negative Photo-Electrical Properties of Molybdenite and Several Other Substances.—W. W. COBLENTZ.—The paper gives a description of new observations of positive and negative spectro-photo-electrical reactions in molybdenite, silver sulphide, etc., as dependent upon temperature as well as magnitude and direction of the current through the crystal. It is shown that for radiation of wave lengths less than 0.7μ the photo-electrical reaction in a certain sample of molybdenite is positive or negative depending upon the magnitude and direction of the current through the crystal. In three appendices data are given, (1) on a frequency relation in the sensitivity bands of molybdenite, (2) on a survey of the general spectro-photo-electrical properties of substances, and (3) on thermal radiophonic signaling apparatus.—*Scientific Paper No. 398, U. S. Bureau of Standards*, Oct. 11, 1920.

Electrochemistry and Batteries

The Chemical Industry of Switzerland. — DR. A. LANDOLL.—Information concerning the manufacture of chemical-pharmaceutical industry products, tar dyes and synthetic perfumery in Switzerland. It is shown how the development of the electrochemical and electrometallurgical industries in Switzerland has been greatly extended during the last two decades by extensive developments of water power in that country.—*Chemical and Metallurgical Engineering*, Jan. 5, 1921.

Units, Measurements and Instruments

Measurement of Magnetic Blow-Out Forces in Circuit Breakers.—A. C. BARTLETT.—It is shown that in the operation of ordinary circuit breakers the magnetic blow-out effect exists to a considerable degree. Comparative values of the magnetic blow-out in certain variously shaped circuits were required, and a scheme was devised for making these measurements. The method, together with some data derived, is set forth by the author.—London *Electrician*, Jan. 7, 1921.

A Loop Test for High-Resistance Faults.—H. V. HIGGITT.—This test is described as a modification of the loop test devised by Professor Jamieson, which gives an accuracy of the same order as a Varley loop, the accuracy for high-resistance faults being more or less proportional to the resistance of the fault. By the method described here the accuracy is independent of the fault's resistance, though the higher the latter the longer is the time required to take the test. The test is dependent upon the accumulation of charge in the capacity of the line.—London *Electrician*, Jan. 21, 1921.

Telegraphy, Telephony and Signals

Wireless Railroad Signals.—A new scheme of railroad signaling developed in Germany is described in which a sending apparatus has been placed on the locomotive with the loop antenna so suspended from the underside as to cause electric waves to be radiated toward the permanent way. At points of the road where signals are to be given to the train there are tuned circuits made up of loops, the characteristic waves of which are identical with the wave length of the transmitter. A visual signal within locomotive cabs gives well-defined indications when the track devices are passed.—*Wireless Age*, January, 1921.

The Capacitance of Flat-Top Antennas.—W. H. ECCLES.—The author discusses the equation proposed by L. W. Austin for antenna capacitance, which, he says, is applicable with considerable accuracy to all flat-top antennas of any reasonable shape. He proposes a formula, however, which he holds to be simpler than the Austin formula and gives results accurate within 1 to 3 per cent.—London *Electrician*, Jan. 14, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Supreme Court Upholds Utah Commission in Special Contract Case

THE Utah Supreme Court on Feb. 25 rendered a unanimous decision sustaining the Utah Public Utilities Commission in the special contract case. This was the case decided by the Utah commission on Oct. 22 last whereby all existing special power contracts of Utah Power & Light Company customers in Utah were declared discriminatory and such business was ordered placed on standard schedules. See ELECTRICAL WORLD for Oct. 23 and Nov. 29. Thirteen customers appealed to the Supreme Court of the state on the ground that the commission had no authority to change any of the terms of contracts entered into prior to the creation of the commission. This is one of the most important cases ever handled by the Utah commission. It involves additional revenue to the power company of approximately $1,000,000 annually.

Reservations Already Coming in for N. E. L. A. Convention

RESERVATIONS for the forty-fourth annual convention of the National Electric Light Association, to be held in Chicago at the new Drake Hotel, May 31 to June 3, are already being received at the association's headquarters. At the next meeting of the executive committee, which will be held in Chicago on March 15, it is expected that many plans for the convention will take definite form and a preliminary list of speakers will be drawn up.

On Monday and Tuesday of next week the sub-committee of the Commercial Section will meet at the association rooms in New York for the presentation of their reports, and on Wednesday the executive committee of that section will meet for the purpose of mapping out its part of the program for the convention.

Engineering Council Urges Harding to Appoint Engineers

PRESIDENT HARDING has been requested by the American Engineering Council of the Federated American Engineering Societies to appoint an engineer as Assistant Secretary of War and to name an engineer for the vacancy on the Interstate Commerce Commission. Both communications were authorized by vote of the executive board of the council, of which Herbert Hoover is president.

The appeal to Mr. Harding to select an engineer as Assistant Secretary of War states that this position is one requiring "very special qualifications, a large part of which are concerned with engineering." The appointee, the appeal urges, must possess technical knowledge and executive ability and must be familiar with cost of construction and operation as well as having experience with various types of employees.

In requesting Mr. Harding "to give earnest thought to the selection for the Interstate Commerce Commission of a man who to his other qualifications adds the training and experience of an engineer familiar with transportation problems," the communication says:

"The engineer's training fits him for that mode of thinking which is indispensable to impartiality of judgment. One important function of the commission is the valuation of public utilities, and another is the determination of relationships and responsibilities of the management of such utilities to the public. No other body of men has given such extensive and scientific consideration to these matters as have members of the engineering profession."

House Votes Down Muscle Shoals Ten-Million-Dollar Appropriation

BY A VOTE of 193 to 182 the House of Representatives has refused to accept the Senate amendment to the sundry civil appropriation bill, granting $10,000,000 for completion of the Wilson Dam at Muscle Shoals. This is the second time that the House has refused to appropriate money for the completion of this project.

Fundamentals Laid Down in Detroit Electricians' Wage Controversy

SOME fundamentals were laid down in the decision just made public of the Council on Industrial Relations for the Electrical Construction Industry regarding the Detroit electricians' wage controversy. The employing electrical contractors had cut union wages in January from $1.25 to $1 per hour, on the ground that non-union shops were paying under $1 per hour and therefore were making competition too difficult and because the cost of living was much lower. The union men refused to accept the cut and denied the two statements above given.

The matter finally came before the council for settlement, and the council took the stand that the men were entitled to as high a standard of living as they enjoyed prior to war conditions, or in 1914. This standard was felt to be commensurate with the then current wage, or $4.56 per day. In addition, the council accepted the figures of the National Industrial Conference Board that 79.6 per cent of a workman's budget is for subsistence and 20.4 per cent for other purposes. The council then took the commodity index of the Bureau of Labor Statistics for the twelve months from Dec. 1, 1919, to Dec. 1, 1920, and applied the increase over the 1914 index to 79.6 per cent of $4.56, leaving the remainder the same. On this basis a daily wage of $10 was determined, and consequently it was held that the old wage should obtain until July 1, 1921.

The council was not inclined to give much weight to the matter of union and non-union labor competition. It did, however, state quite strongly that a union work-

man receiving the high wage owed it to himself as well as to his employer to work more efficiently and do more work than he has been accustomed to do in the same time. The council was also not in favor of having wage changes on the hour basis. It felt that a workman was interested more in the yearly income and that this was not considered in the hour scale. While the council was forced to exclude consideration of employment security, still it felt that a fair wage "is one which, upon an assumption based on statistics as to the duration of employment, will satisfy as nearly as possible all the workers' needs. The adequacy of the wage to satisfy all of the workers' needs is regulated by the cost of living."

Probability of a Three-Man Commission for New Jersey

SHOULD the lower house of the New Jersey Legislature pass the Walworth bill over the Governor's veto, the state will have a three-man commission, removal of which will no longer be a right of the Governor. The State Senate has already passed the bill over the Governor's veto, and the measure was under consideration by the House as this was written.

The Governor objected to having the power of removal taken from the hands of the chief executive of the state. He removed the old board, and it was this action which led to the present bill. The board in question was not the first public utility commission to be used as a political football by a New Jersey Governor.

Increasing Activity Seen in Street Lighting

PLANS for street-lighting systems are going ahead in a number of cities, and as soon as frost is out of the ground there should be considerable activity in this field of construction. Some of the systems are more comprehensive than others. For the Hollywood district of Los Angeles, Cal., for instance, the City Council is discussing the installation of a system estimated to cost between $1,250,000 and $1,500,000. Work has already started on the extension to the Fort Worth (Tex.) system.

When the 800 300-watt lamps are installed in the southern section of the city, Light Commissioner Selwyn Smith states, the street lighting of Fort Worth will have been increased 75 per cent.

The first lamps of the new type which is to be the standard for Rochester, N. Y., were received about two weeks ago after waiting, it is stated, eighteen months.

Bids for a boulevard lighting system for Lima, Ohio, have been authorized for advertisement. It has been decided to proceed with plans for construction as speedily as possible.

Kansas City (Mo.) officials are seriously considering replacing gas lighting for streets with electricity. The city now has 5,419 electric street lamps and 5,600 gas lamps. It is proposed to substitute for the latter 2,600 electric lamps, using 600-cp. lamps in the downtown district and 400-cp. lamps in the outlying districts.

Terre Haute, Ind., New Brunswick, N. J., and a number of other cities are already considering smaller additions to present systems.

Service at Cost Proposed for New Orleans

AS A REMEDY for the public utility situation in New Orleans a group of bankers has proposed that a service-at-cost plan be worked out for the New Orleans Railway & Light Company. It is admitted by both the city and the company that the present facilities are inadequate. J. D. O'Keefe, receiver for the company, has stated that to supply adequate service $5,000,000 should be expended at once on the company's electric light, railway and gas properties. To do this, he contends something must be done to restore the company's credit, and he proposes the establishment of a service-at-cost plan for each of the three classes of service.

National Parks Exempted from Water-Power Act Provisions

THE House of Representatives on Tuesday passed the Senate bill exempting national parks from the provisions of the federal water-power act. The measure, which then went to the President, would prevent construction of commercial dams and power houses in national parks.

Utility Financing at Longer Maturities and Lower Yields

THE tendency that appeared in January in the financing of electric light and power public utilities toward longer term securities grew stronger in February, with a noticeable lowering of the yields. Eight per cent is the highest yield that appears, and but three of the ten issues carry that. The total for the month, $20,139,000, which is only about half that for January, is nearly twice as high as the corresponding total for February, 1920. The two most important issues are $8,000,000 in thirty-year bonds of the Pennsylvania Power & Light Company, sold at 92, to yield 7.68, and $6,000,000 in twenty-year bonds of the Oklahoma Gas & Electric Company, sold at 95, to yield 8 per cent.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Offered at
Pennsylvania Power & Light Co.	$8,000,000	30-year	First and refunding mortgage bonds Series A	Refunding and new construction	7	7.68	92
Manchester Traction, Light & Power Co.	914,000	31½-year	First mortgage sinking fund bonds	Refunding	7	7.30	96.25
Idaho Power Co.	1,000,000	26-year	First lien and general mortgage gold bonds	.....	7	7.50	94.25
Cohoes Power & Light Corp.	725,000	11-year (due Jan. 1, 1929)	First mortgage gold bonds	.....	6	7.50	91
Oklahoma Gas & Electric Co.	6,000,000	20-year	First and refunding mortgage gold bonds	Refunding	7½	8	95
Newburyport Gas & Electric Co.	650,000	15-year	Series A first mortgage gold bonds	.....	7	....	Par
Northern Virginia Power Co.	1,200,000	9-year	First general mortgage gold bonds	Refunding and new construction	7	....	.....
Iowa Railway & Light Co.	400,000	20-year (due Sept. 1, 1932)	First and refunding mortgage gold bonds	.....	7	7.80	94
Portland Railway, Light & Power Co.	1,000,000	5-year	Gold notes	New construction	8	....	.....
Houston Electric Co.	250,000	....	Notes	Repairs	8	....	.....
	$20,139,000						

Goodwin Joins the Society for Electrical Development

WILLIAM L. GOODWIN has joined the Society for Electrical Development, Inc. This news is contained in an official announcement issued from the society's headquarters by President W. W. Freeman. Thus the two most potent co-operative forces now at work in the industry have been consolidated. Mr. Goodwin has obtained a leave of absence from the General Electric Company and assumed his new duties as assistant to the president on March 1.

The notice sent out by the Society for Electrical Development is as follows: "President W. W. Freeman announces officially that William L. Goodwin will join the staff of the Society for Electrical Development on March 1 in the capacity of assistant to the president. By securing the services of Mr. Goodwin the society aims to consolidate the efforts which have been exerted so actively in recent years in the interests of genuine electrical co-operation throughout the country with the systematic work conducted by the Society for Electrical Development, and by such direct consolidation to promote co-operative development throughout the industry along lines of the broadest scope and most intense activity. Mr. Wakeman as general manager and Mr. Goodwin as assistant to the president will direct the activities of the society co-ordinately, under the authority of the president and with the active advice and support of the executive committee and directors.

W. W. FREEMAN
President

J. M. WAKEMAN
General Manager

W. L. GOODWIN
Assistant
to the President

C. L. EDGAR
Chairman
of the Executive Committee

"The directors' meeting held Feb. 19, at which broad plans of expansion were discussed and unanimously approved, was attended by fifteen directors, many of whom traveled long distances for the purposes.

"The program of work for the society during the coming year is being planned with enthusiasm, and the announcement of further important developments may be expected from time to time."

The news of Mr. Goodwin's appointment spread rapidly and gave rise to much interesting comment. In elaborating on the new line-up President Freeman said:

"Mr. Goodwin has done a fine work, and he is generally recognized as a prominent exponent of co-operation in the industry. Our aim in getting him to join with us was to consolidate all of the various agencies which have been active in the work of co-operation under the direction of the Society for Electrical Development and to expand that work to the utmost. Mr. Goodwin's connection with the society will give him a fine opportunity for employing his talents. He comes with a full recognition of the work which the Society for Electrical Development has done and will enter enthusiastically and energetically on a campaign along wider and more active lines. As a result of his coming we expect the interest in the society's work will be greatly increased and that this interest will be reflected in an enlarged membership and greater financial support. I rejoice that our conferences have culminated in such a happy union of forces, and I look to a program of larger effort with confidence and enthusiasm."

J. M. Wakeman, who has been the general manager of the society since its formation, had this to say when questioned by a representative of the ELECTRICAL WORLD this week: "It is unnecessary for me to comment on Mr. Goodwin's affiliation with the Society for Electrical Development or to introduce him to the membership. His great work in the interest of co-operation in the electrical industry is known to all, and it is gratifying to our membership as it is to me and the officers of the staff of the society that Mr. Goodwin's work is to be co-ordinated with the society's activities."

Very flattering indeed were the remarks of Charles L. Edgar of the Boston Edison company and chairman of the executive committee of the society which negotiated for Mr. Goodwin's services. "I am very much delighted at Mr. Goodwin's acceptance of the post of assistant to the president of the Society for Electrical Development," said Mr. Edgar. "Mr. Goodwin brings to the society experience gained in widespread travels through the country which have brought him in contact with the industry and given him the opportunity to stir up local enthusiasm which will henceforth be maintained through the co-operative efforts of the society itself. He will now represent all the leading branches of the industry through their active connection with the work of the society. Enthusiasm will no longer be permitted to slacken when he leaves town, because the society will follow up his pioneer work and insure its continuous development along co-operative lines. In other words, Mr. Goodwin

can now play the co-operative game better than ever, and the opportunities for future service by the society and Mr. Goodwin are simply wonderful. The field of service which he is entering will be greatly broadened by the hearty interest which manufacturers, jobbers, contractor-dealers and central stations are showing in the work of the society, to which is being accorded their able and enthusiastic support."

Interest naturally centers in Mr. Goodwin's impressions of his new job. While some time will elapse before his plans are finally matured and acted on, Mr. Goodwin is well pleased with the arrangement and intends to pitch into the work with his usual enthusiasm and vigor. He said:

"I have tied up with the Society for Electrical Development because I see a great opportunity for co-operative effort and because I appreciate that more can be accomplished jointly than singly. For four years I have been hammering away on co-operation. Now comes the chance to affiliate with an organization that has been engaged in co-operative work along somewhat parallel lines. Naturally I welcome the opportunity because it puts behind my work an organization representing no special interest. The society has done a fine job in educating the public to 'do it electrically,' and its efforts have borne fruit. A lot of insiders in the industry must still be educated, however, and that, I take it, is my job. The task which I shall cut out for myself will be to expand the society from within, to help the contractor-dealer, jobber, manufacturer and central station to see where they fit in and to teach the different interests the power and value of co-operative effort through the Society for Electrical Development."

Heavy Traffic Electrification an Economic Necessity

ECONOMIC aspects of heavy electric traction were outlined in a paper by A. H. Armstrong, chairman electrification committee, General Electric Company, at a well-attended meeting of the electrical section of the Franklin Institute, held in Philadelphia on Feb. 24. During the delivery of the address an interesting series of appropriate lantern slides was shown. These depicted recent snow scenes on the Milwaukee electrification, as well as typical heavy electric traction scenes in this country and abroad.

Coming to the place of the electric motor in the solution of the transportation problem, Mr. Armstrong said that electricity has amply proved its effectiveness in the operation of light high-speed trains in congested zones. It gives opportunity to relocate and redesign the whole terminal railway property along lines impossible with the steam engine. In addition to the passenger terminal development, the way has been shown to the solution of the equally vital problem of handling freight and express matters in city terminals. The steam terminal is not immediately adjacent to the shipper or center of distribution in a large city, nor is it well adapted to the expeditious or economic handling of freight. The electric terminal, on the contrary, may be located with proper regard to the needs of the shipper in the very center of the city if necessary.

Taking up the electric locomotive, Mr. Armstrong rated it as the most efficient and flexible known means of transforming potential into mechanical power. The electric locomotive also offers great advantages for relieving the congestion on mountain-grade divisions, which has reached such a point that additional rails must be laid to obtain the needed relief with continued steam operation. The development of the more powerful electric locomotive is the determining factor in the matter of grade revision, double tracking and mountain division operation.

Another marked advantage of the electric locomotive which was pointed out is its great reliability and consequent low cost of maintenance. The possibility of regenerating power also should not be forgotten.

Illinois Utilities to Hold Convention

THE electric power and railway and gas utilities of Illinois will hold their annual convention at the Hotel Sherman in Chicago on March 15 and 16 next. The morning session will be joint, while the afternoon sessions provide for parallel meetings for each of the three divisions. The program, so far as it relates to the electric light and power division, is as follows:

TUESDAY, MARCH 15

Morning Session.—President's address, W. M. Willett, president Illinois Gas Association; auditing committee's report, E. E. Corken, Central Illinois Light Company; secretary-treasurer's report, R. V. Prather; "Financing Through Your Customers," John F. Gilchrist, Commonwealth Edison Company.

Afternoon Session.—"Coal and the Electric Industry," W. L. Abbott; "Modern Accounting Methods," J. H. Thomas; "Testing of Instrument Transformers," F. A. Kartak.

WEDNESDAY, MARCH 16

Morning Session.—"What the National Association Is Doing"; American Gas Association, Charles A. Munroe, president; American Electric Railway Association, Philip H. Gadsden, president; National Electric Light Association, Martin J. Insull, president.

Afternoon Session.—"Methods of Measuring Reactive Factor and Apparent Power for Basis of Rate Making," Ray H. Wolford; "Comparative Cost of Producing Power by Isolated Plants Versus Central Station Under Present Conditions," John H. Mitchell; "Hazards of Faulty Switchboard Construction," Roscoe M. Pert.

The annual banquet will be held on Wednesday evening.

Remaining Federal Power Commission Regulations Ordered Promulgated

THE remaining regulations of the Federal Power Commission—those numbered from 11 to 20 inclusive—were ordered promulgated at the meeting on Feb. 28. It was pointed out that there was great difference of opinion as to the provisions of the regulations. This, in addition to their highly technical character, had made it necessary for the commission, with its limited personnel, to take some time in their preparation. In answer to the charges which have been made that the commission is holding up a large number of applications pending investigation, it was asserted that there are only two cases in which the charge is true. One case is on the Deschutes River, where there is a conflict between irrigation and power developments, and the State of Oregon has requested a federal investigation prior to action. The other case is on the Colorado River, where there is a similar conflict and where an investigation has been requested by Wyoming, Colorado, Utah, Nevada and Arizona.

First Licenses Under Water-Power Act Granted This Week

WITH the completion of its regulations, the Federal Power Commission was able at its session on Feb. 28 to authorize the issuance of its first licenses and permits. Incidentally the meeting was the final one during the term of office of the present commission. As a result every effort was made to take definite action on all pending matters so that the incoming commission would have to deal with a minimum number of pending questions.

Licenses were issued as follows: The Niagara Falls Power Company, Niagara River; Henry Ford & Son, Inc., Hudson River at Troy, N. Y.; Southern California Edison Company, authorizing an extension of its Big Creek system; Luther Hill, authorizing a project of less than 100 hp. in California.

Preliminary permits were issued as follows: Niagara River Power & Water Supply Company, Niagara River; Hydraulic Race Company, Lockport, N. Y.; Dixie Power Company, White River, Ark.; Washington Irrigation & Development Company, Columbia River, Wash.; Pitt River Power Company, Pitt River, Cal.; United Mills Company, Harpers Creek, N. C.

Licenses also were issued for transmission lines as minor parts of complete projects as follows: Southern California Edison Company, California; Coast Valleys Gas & Electric Company, California; Amazon Dixie Mining Company, Idaho; Butte-Jardine Metal Mining Company, Montana; Spanish Belt Silver Mining Company, Nevada; Paving Granite Quarries Company, South Dakota.

The license authorized for the Niagara Falls Power Company covers 19,500 cu.ft. of water per second to be developed under the Hydraulic Power Company plan. The license is to cover a period of fifty years. The company agrees, as a part of the consideration, to amortize completely its investment in Niagara plants Nos. 1 and 2 and Hydraulic plant No. 2. The investment in these plants is to be written off completely during the period of the license. Valuation is to be undertaken later.

The commission voted unanimously that in case of a modification of the existing treaty so as to permit of additional diversion it is the commission's judgment that it should be handled by the "over-the-top" developments, whereby the full head can be obtained by carrying the water down to the vicinity of Lewiston.

A preliminary permit was authorized for the Niagara River Power & Water Supply Company, covering 30,000 sec.-ft. in the gorge. The permit is for two years, with the understanding that before the license is issued the permittee will submit plans for the development

The commission voted to issue a preliminary permit to the Hydraulic Race Company covering a diversion of 500 cu.ft. per second through the barge canal, upon condition that before the issue of the license the applicant would submit complete plans for the utilization o that amount of water under a head approximatin, that which could be obtained at Niagara Falls under conditions which would allow the efficient use of the water. This is the amount of the diversion which is now allowed under a permit granted by the Water Depart ment prior to the enactment of the water-power act.

The other seven Niagara River applications were rejected. The application of the Niagara Power & Development Company and of the Niagara, Lockport & Ontario Power Company were rejected on the ground that the commission is without authority to issue preliminary permits for the diversion of water from the Niagara River above the falls in excess of the amount authorized by the treaty. No action was taken by the commission which would indicate approval or disapproval if the additional diversion should be arranged.

The application of the city of Buffalo was dismissed because no specific plan of development was submitted. The commission also is of the opinion that the city has no legal authority to carry out any development.

The application of J. Kenard Thomson and Peter A. Porter was rejected because the application comes within the jurisdiction of the International Joint Commission and because of a doubt entertained by the commission as to the feasibility of harnessing the Niagara River below the falls.

The application of the Western New York Utility Company for the diversion of an additional 500 sec.-ft. through the Erie Canal was rejected, as was the application of the Niagara Gorge Power Company. The application of Millard F. Bowen for a canal, reservoirs, power houses, conduits and locks between Lake Erie and Lake Ontario also was denied.

Moves for Commission Regulation in Minnesota

THE Minnesota Legislature is considering a bill which if passed will permit the council of any city or village, except cities of the first class, to place before the Railroad and Warehouse Commission for adjustment questions of rates which the council feels should be changed. There is also a bill placing authority in the hands of cities of the first class the right to regulate line construction practices and also to regulate rates and other practices. This latter bill has appeared in every session of the Legislature during the past eight years but has always failed of passage. At present there is no state regulation of utilities in Minnesota.

Supply Manufacturers to Consider Uniform Standards at Annual Meeting

A MEETING of a joint committee of the Associated Manufacturers of Electrical Supplies representing factory mutual and straight line insurance companies will be held at the association's headquarters in New York on March 14 to discuss the possible adoption of a uniform standard of electrical requirements. At present there are some differences in the rules and regulations of the National Board of Fire Underwriters, the insurance companies and municipalities which the joint committee plans to reconcile. The general standards committee of the association will meet on the same day, when it is expected to adopt some standards which have been worked out. This committee will also elect new officers at this meeting.

The date of the meeting of the Heating Appliance Section, which was scheduled for March 17, has been changed to March 10 and will be held in the association rooms.

The board of governors will hold a meeting on Monday evening, March 14, in the association headquarters for the consideration of officers' reports, financial budgets and other matters to be acted upon at the regular meeting on the following day. The newly elected governors will be announced on March 15.

Insull Properties Make Good Showing

IN SPITE of the adverse conditions surrounding last year's operations, the Commonwealth Edison Company's financial statement for 1920, issued last week, showed only a slight decrease in net earnings over 1919. With gross earnings nearly $5,000,000 ahead of 1919, the increase in coal costs was such as to prove the determining factor in wiping out the increase, and net earnings show 9.2 per cent on the common stock as against 9.61 per cent for 1919. The net for 1920 was $4,708,401, as against $4,847,128 in 1919. The Public Service Company of Northern Illinois showed an increase on the common stock from 7.38 per cent in 1919 to 7.47 per cent in 1920.

In fifteen months the Commonwealth Edison Company stockholders of record have increased from 6,838 to 17,396, and when the installment purchasers gained in the recent campaign have paid for their shares the number will be upward of 26,000. The Public Service Company of Northern Illinois will show an increase in stockholders from 2,445 to 13,000 when installment purchasers have fully paid up.

Water-Power Trespass Procedure Formulated

A FORM of procedure to cover trespass was adopted by the Federal Power Commission at its meeting on Feb. 28. It is made the duty of the department having jurisdiction to report to the Federal Power Commission that a power project is going forward without permit or license. The commission then will call upon the trespasser to apply for a permit or license, furnishing at the same time copies of its regulations. The department concerned is to furnish a statement of any damages that may have been occasioned by the trespasser, and the commission will impose, as a condition precedent to the issuance of a license, an obligation to make payment for such damages as may have been caused prior to the issuance of the license.

Prospecting for oil and gas on lands reserved or classified as power sites is to be permitted on the understanding that the prospecting activities are in no way to interfere with the use of the lands for the purpose of power development. Prospecting permits will contain a clause in which the permittee agrees to vacate promptly and remove any property he may have on the lands in question.

Announcing End of War Troubles Proves Profitable, Says Sunny

WITH the beginning of the present year the Illinois Bell Telephone Company, through B. E. Sunny, its president, announced that so far as service and operating conditions were concerned the war emergency was at an end and operating troubles could not in the future be charged to war conditions. Commenting on that announcement recently, Mr. Sunny said to an ELECTRICAL WORLD representative:

"Many of our people were apprehensive as to the effect of such an announcement. As a matter of fact, we have had surprisingly little comment from our subscribers or the public. There is a great deal in the psychological effect of such things. Ninety-five per cent of the people are reasonable, ready to accept statements as to conditions, and will help to make relations as pleasant as possible if they are convinced that an honest effort is being made to carry out pledges. The small percentage that are overwilling to complain have had surprisingly little to say. Of course, when the announcement was made we had reached a position where service was normal and as free from operating errors as the human factor will permit.

"The most important result has been on our own forces. It is easy to excuse difficulties when a reason as strong as that due to war conditions is available. The announcement removed any possibility of falling back on that excuse and put us on the service basis existing previous to the war, when service given depended on the ability of the organization unhampered by abnormal conditions. As a result we have experienced a marked improvement in the morale of our operating forces.

"While in many respects we must, in common with all other business, feel the effect of the war for years to come, the time has arrived when the public is no longer willing to listen to the war excuse as a reason for failure to give service for which it is paying. With material and labor once more available, service with existing facilities can be given. The extension of service to cover hitherto undeveloped fields is another matter."

Boston Chamber of Commerce Opposes St. Lawrence-Great Lakes Project

IN A REPORT made a few days ago to the New England Traffic League a special committee of the Boston Chamber of Commerce urges strong opposition to the St. Lawrence-Great Lakes navigation and water-power project on the ground of too great cost and because Canada would benefit the most from the power produced. The committee averred that even if 3,500,000 hp. could be developed, as is estimated by those backing the project, Canada now controls at least two-thirds of this, while transmission of the remainder to the United States would be costly and chimerical.

Applications of Hot Cathode Tubes Are Increasing

BEFORE an audience that packed the auditorium of the Engineering Societies Building, the development and ever-increasing usefulness of electron tubes were outlined by Dr. Saul Dushman of the research laboratory of the General Electric Company on Feb. 25, when he spoke on this subject to the New York Section, A. I. E. E.

One of the very important applications to which hot-cathode or electron tubes have been put, according to Dr. Dushman, is the rectification of small amounts of energy, and this is made use of in the precipitation of smoke and gases. He said that electron tubes offer a much better means of rectifying high-voltage alternating current than the mechanical rectifiers now used in the Cottrell precipitation process.

Dr. Dushman presented in simple language the development of the various tubes known as kenetron, pliatron and dynatron by Dr. Irving Langmuir and others and showed how these can be applied to transmission and reception of signals, rectification of alternating currents and the production of alternating currents from direct currents by reversing the normal tube operation. An interesting phenomenon was pointed out

in the discussion of the dynatron attributed to Dr. Hull, which exhibits the characteristics of a stable negative resistance. The Coolidge X-ray tube was said to be a long step in advance of older tubes in its permanence and dependability.

A. A. E. Holds Conference on Public Information

THE importance of the engineer's telling the story of his work as it progresses was emphasized by F. H. Newell of Washington, D. C., at the national engineering conference on public information held in the Congress Hotel, Chicago, on Feb. 25. Mr. Newell pointed out that an employer is entitled to know what he is receiving from an employee, but cannot know unless he receives from time to time evidence of work done.

The engineer engaged in work in which the public is interested can gain recognition only through publicity that tells truthfully and forcefully the work that he is doing.

John G. D. Mack, state chief engineer of Wisconsin, in discussion, brought out the importance of avoiding the use of technical language in giving publicity to engineering matters. Such information can be presented to the public in a non-technical language and if this information is to be effective it must be done in this way.

That an independent technical press is recognized by the public as an interpreter of constructive thinking in industry was the assertion of F. M. Feiker, New York, vice-president of the McGraw-Hill Company, who discussed the engineer as a force in the solution of social as well as economic problems. He expressed the hope that a thorough understanding of the opportunities for the engineer and the independent technical and engineering press would grow out of the conference on public information.

The conference was organized and held by the American Association of Engineers.

Ontario Municipal Electricians Condemn Two-Dollar-per-Horsepower Rental

THE Ontario Municipal Electrical Association at its annual meeting, held at Toronto on Feb. 25, vigorously opposed the annual tax or rental of $2 per horsepower proposed by a committee of the Ontario Legislature to be levied on the undertakings of the Ontario Hydro-Electric Power Commission. The following resolution was passed:

"Resolved, That the Ontario Municipal Electrical Association places itself on record as being entirely opposed to the recommendations made by the committee of the Ontario Legislature and recommends that the Legislative Assembly do not take any action along the lines suggested until after a thorough investigation by competent authorities and without giving all interested parties a full opportunity to be heard."

Other resolutions adopted included one asking that the province transfer to the commission in trust for the municipalities the plants composing the Central Ontario system and one asking for a fixed tenure of office of the members of the Hydro-Electric Power Commission, and that the municipalities be allowed to elect representatives to the commission, the members of which have been heretofore appointed by the Ontario government.

The following officers were elected: President, Willoughby Ellis of Hamilton; vice-presidents, J. Ernest Banwell of Windsor, C. Alfred Maguire of Toronto, R. F. Elliott of Kingston, W. K. Sanderson of St. Thomas; secretary-treasurer, T. J. Hannigan of Guelph.

Home-Rule Control of Utilities Revived in Arkansas

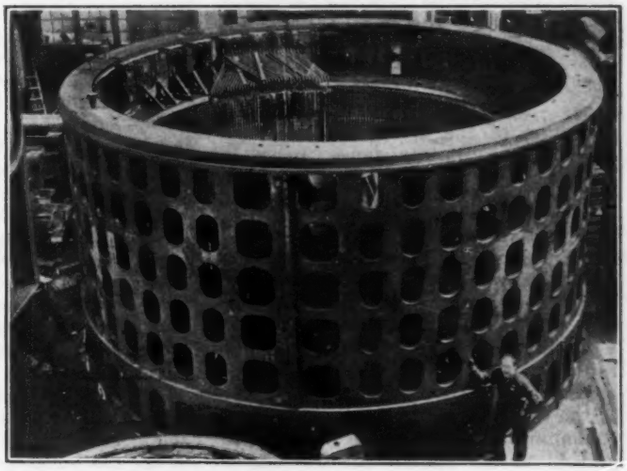
PUBLIC utilities in Arkansas are returned to home-rule control by the Emory-Walls bill, which has been passed by both houses of the Arkansas Legislature now in session and has been signed by Governor McRae. This bill repeals the act of 1919 which abolished the Arkansas Railroad Commission and substituted the Arkansas Corporation Commission. In repealing this act provision is made for a new Railroad Commission, to which certain powers formerly exercised by the Corporation Commission are transferred.

The new commission will have general jurisdiction over all common carriers, railroads, express companies, car companies, freight lines, toll bridges, street railways, electric and other interurban lines, telegraph and telephone companies, etc. No jurisdiction is vested in the commission, however, over any matter of rates or regulations of public utilities operating within a municipality, such jurisdiction being expressly conferred upon the municipality.

Procedure is prescribed whereby municipalities may assume ownership and direct operation of utilities after an election by the people. Provision is made for appeals from the rulings of any municipality in regard to rates or other questions to the Circuit Court.

With the enactment of this bill some question has arisen as to the status of companies which are operating under indeterminate permits issued by the Corporation Commission.

World's Highest-Rated Waterwheel Generator



FOR the Queenston-Chippawa development of the Hydro-Electric Power Commission of Ontario, now in the process of construction, there are on order five 45,000-kva. waterwheel generators, a new world-record rating. One of these machines, now ready for shipment, is here shown being set up in the manufacturer's shop. The generators are of Canadian manufacture.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Manufacturing Nitrogen by New Process.—The manufacture of nitrogenous compounds by a new electrochemical process has been begun in Sweden. The method has many points of resemblance with the Haber process, but is said to be more economical and reliable. Heating is effected by electricity, and, according to the statements made before an engineering body at Gothenburg, 1 kg. of combined nitrogen can be made with the consumption of 12 kw.

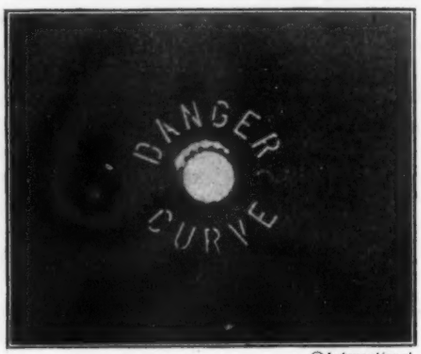
Cost of Caribou Plant.—Authority has been sought by the Great Western Power Company of California to issue general-mortgage 8 per cent bonds in the amount of $5,000,000, to mature in 1936, in order to complete its Caribou plant on the north fork of the Feather River, Plumas County, as well as to construct a transmission line carrying 165,000 volts from the plant to a substation at Valona, Contra Costa County. The company shows that the estimated total cost of the Caribou plant and transmission line will be $15,475,300, of which nearly $11,000,000 has already been provided

Bureau of Mines Electrical Specifications Before A. E. S. C.—The United States Bureau of Mines has brought three of its publications to the attention of the American Engineering Standards Committee for consideration as "tentative American standards." These publications concern specifications for portable electric mine lamps and storage-battery locomotives and safety rules for installing and using electric equipment in bituminous coal mines. By a special provision in the procedure of the committee important specifications in existence prior to 1920 may be approved without going through the regular process followed in new work.

An Italian Hydro-Electric Development.—One of the noteworthy hydro-electric installations of recent construction in Italy is on the Scoltenna, a torrential stream in an unusually rainy district in the province of Modena. *Le Génie Civil* gives a description of the dam and power house based on a communication from one of the engineers to the Italian Electrotechnical Association. The total head utilized is 367 ft. The dam is of the multiple-arch type with a maximum height of 78 ft. and a length of 250 ft. The reservoir capacity is 21,000,000 cu.ft., and a canal 16,600 ft. in length permits 280 cu.ft. a second to flow through the power house. The latter contains two 4,000-hp., 504-r.p.m. reaction turbines coupled to alternators. An annual production of 30,000,000 kw.-hr. is reached.

An Electrometallurgical Installation Planned for North Carolina.—A plan is on foot, according to the director of the North Carolina Geological and Economic Survey, to develop hydro-electric power in Cherokee County, N. C., where there are iron ores in commercial quantities, so as to make possible the establishment in that county of an electric furnace for the reduction of these ores and of other metallic deposits found in nearby territory, such as chromite, rutile and corundum. The town of Andrews is said to be specially interested in the project.

Flashing Beacons to Warn Motorists on National Highways.—The adoption of miniature land beacons which wink eighty warnings a minute has been recommended by traffic engineers as a means of helping to control automobile traffic on the national highways. More than a hundred cities and towns throughout the United States, it is said, have already erected these signals as an aid to motorists. The standardized colors, which, as in the case of railroad signals, are red, yellow and green, are flashed by "land lighthouses." The accompanying illustration shows these signals in use.



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Westinghouse Lamp Company's New Buildings.—The completion or early completion of three new factory buildings is announced by the Westinghouse Lamp Company. One of these buildings is at Bloomfield, N. J., one at Milwaukee and one at Indianapolis. The Bloomfield expansion, on which work began in the spring of 1920, has an area of 230,000 sq.ft., part of the new erection being an extension and the remainder an entirely new building of four stories. On the roof there is a long-range wireless telephone outfit for direct communication with the research laboratory in East Pittsburgh, Pa. The Milwaukee development is a three-story concrete structure with a floor space of 82,000 sq.ft. It is connected to the old building and will afford storage space and recreation facilities. The Indianapolis building was not begun until September, 1920, but it is expected to be complete by May 1 next. It will have four stories and basement, with 160,000 sq.ft. of floor space and facilities for manufacturing 35,000 lamps a day.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Institute of Radio Engineers.—Meeting at New York on Wednesday of this week, the Institute of Radio Engineers listened to a paper on "Piloting Vessels by Electrically Energized Cables," by A. Crossley.

March Meetings of A. I. and S. E. E.—Two papers have been added to those named in this column last week as scheduled for presentation before the Birmingham Section of this association on March 19—"Lubrication of Mill Motors," by J. E. Harrell, and "Value of Research in Steel Mills," by C. H. Watson. In addition to the March meetings of the Philadelphia, Cleveland, Birmingham and Chicago Sections, already announced, the Pittsburgh Section will meet on March 19, when W. A. Meddick, transportation engineer with the Lakewood Engineering Company of Cleveland, will discuss "Mechanical Transportation in Steel Plants."

American Physical Society.—Among the papers presented at the New York meeting of the American Physical Society in Columbia College on Saturday, Feb. 26, were "The Piezo-Electric Resonator," by W. G. Cady of Wesleyan University; "A High-Speed Oscillograph Camera," by E. A. Eckhardt, Bureau of Standards; "Photo-Electric Phenomena in Coated-Filament Audion Bulbs" and "Polarization Capacity and Polarization Resistance as Dependent Upon Frequency," by Ernest Merritt, Cornell University; "The Motion of Electrons Between Coaxial Cylinders in a Uniform Magnetic Field," by Albert W. Hull, General Electric Company; "An Electrical Doublet Theory of the Nature of the Molecular Forces of Chemical and Physical Interaction," by R. D. Kleenman, Union College, and "The Measurement of Paramagnetic and Diamagnetic Susceptibilities in Very Weak Fields," by S. J. Barnett.

Coming Meetings of Electrical and Other Technical Societies

Association of Iron and Steel Electrical Engineers—Philadelphia Section, March 5; Cleveland Section, March 14; Birmingham Section, March 19; Pittsburgh Section, March 19; Chicago Section, March 22.

Oklahoma Utilities Association—Oklahoma City, March 8-10.

American Institute of Electrical Engineers—New York Section, March 11; Providence Section, March 16; Schenectady Section, March 18.

Associated Manufacturers of Electrical Supplies—New York, March 15. (For program see issue of Feb. 26, page 501.)

Illinois State Electric Association—Chicago, March 15-17.

Wisconsin Electrical Association—Milwaukee, March 23 and 24. (For program see issue of Feb. 19, page 448.)

A. I. E. E. (New York Section) and A. S. M. E. (Metropolitan Section)—New York, March 25.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

No Writ of Review Granted Where Commission's Finding Is Justified by Evidence.—The Supreme Court of Colorado refused to grant a writ of review in a suit brought by the Burlington Gas & Electric Company against the Colorado Public Utilities Commission complaining that the town of Burlington had not complied with the law in establishing a municipal electric light plant. The court declared the commission's finding fully justified by the evidence. (194 Pac. 367.)*

Plaintiff in Discrimination Case Has Burden of Proof.—In Cock vs. Marshall Gas Company, in which discrimination was charged, the Court of Civil Appeals of Texas held that in such actions it devolves on the plaintiffs to produce affirmative proof to support their averments and they must show not only a difference in rate but also that the conditions of supply were substantially the same or such as to present no good reason for the rate difference. (226 S. W. 464.)

United States Supreme Court Has No Concern with Delegated Powers of a State.—The United States Supreme Court declared, in affirming judgment against the Erie Railroad Company and other corporations that brought suit to upset orders of the Board of Public Utility Commissioners of New Jersey, that the federal court of last resort has no concern with the question how far legislative or quasi-legislative powers may be delegated by a state to a commission or board. (41 S. C. R. 169.)

Permitting Recovery of Exemplary Damages Without Evidence of Wantonness Held to Be Prejudicial Error.—Reversing the verdict in Poor vs. Western Light & Power Company and remanding the case for retrial, the Supreme Court of Colorado found that, although the inferior court did not err in charging that the jury might find the company guilty of negligence resulting in the injury of a boy from a fallen wire, irrespective of the cause of the break, if the company knew or by the exercise of the utmost care should have known that the wire was down, the court did err in charging the jury that it might return a verdict for exemplary damages if it found that the injury complained of was "attended by circumstances of wanton and reckless disregard of plaintiff's rights and feelings on the part of defendant company," there being no evidence to support such an accusation and it being impossible to determine what portion of the damages awarded was allowed as exemplary or punitive. (194 Pac. 613.)

Proper Instructions on Duty of Electric Company in Maintaining Safe Conditions.—In an action for death resulting from electric shock, it was held by the California Supreme Court, in Robinson vs. Western States Gas & Electric Company, that an instruction in the trial court to the effect that an electric company should not only construct its line in a safe and substantial manner but keep it in such condition was not erroneous as implying that defendant was liable unless the line was absolutely safe, when the instruction was considered in connection with other instructions as to what constituted due care.

Death Due to Mental Strain Not "Accidental."—In O'Connell vs. Adirondack Electric Power Corporation the defendant appealed to the New York Supreme Court, Appellate Division, against a decision of the State Industrial Commission that the chief operator of the company's electric system, who died in his office while directing the restoration of service interrupted by a storm, lost his life from "accidental injuries" within the meaning of the workmen's compensation law. Ruling against the Industrial Commission, the court said, after quoting the medical testimony, which was that the fatality was due to dilatation of the heart or some similar ailment: "It would be a strange perversion to term the mental apprehension of news communicated an accident or an occurrence to the mind or body of the person receiving such news. It would be particularly strange in such a case as this, where the news conveyed was of a kind neither infrequent nor unexpected nor alarming." (185 N. Y. S. 455.)

Circumstances Under Which Diverted Water May Not Be Returned to Old Channel.—May one who has acquired the right to divert water from a watercourse on his land return it to its original channel when by so doing he damages the land of a lower riparian owner owing to the fact of a freshet having seventeen years before changed the course of the channel? This question, at issue in Stough vs. Steelville Electric Light & Power Company, the Missouri Court of Appeals decided against the defendant. The company had dammed a spring to make a reservoir, the water being brought through a race to furnish power to the company's plant and thence discharged so that it found its way back to the natural bed of the stream. A landowner is entitled to change the course of a natural stream within the limits of his own land, the court held, where he does not by so doing cast on the land of an adjoining proprietor water which would not naturally flow there, but restores the water to its natural channel before it reaches the land of the adjoining proprietor. (226 S.W. 295.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Stock Dividends Declared Illegal.—The Noblesville Heat, Light & Power Company having sought to transfer $100,000 from its surplus account to its capital account and to issue a corresponding amount of capital stock to its shareholders, the Indiana Public Service Commission declared such a transaction forbidden by the Indiana statutes.

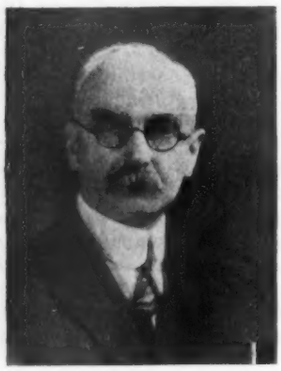
Approval of Competition in Certain Circumstances.—The New York Public Service Commission, Second District, has held that an application for a certificate of convenience to construct and operate an electric transmission line to serve a manufacturing company in occupied territory will be granted where the existing utility's surplus energy is limited and it is owned and controlled by competing industrial companies.

Conflicting Interests of Transmission and Telephone Companies.—In granting to the Homer Electric Light & Power Company the right to construct a 13,000-volt transmission line along a highway in parallel with telephone circuits (see ELECTRICAL WORLD, Feb. 5, page 336), notwithstanding the prior occupancy of the route by the telephone company, the Public Utilities Commission of Illinois said: "In considering possible interference between supply and signal lines and the routing of new lines the commission must take into consideration every condition which, broadly speaking, may ultimately cause a burden to be placed on the citizens served with electric and telephone service, and the problem, therefore, becomes one of selection of the construction which will best serve the largest number of citizens. It is true that inductive interference in this case might be largely avoided by construction of a low-voltage line along the hard road to serve the applicants with electric service. Such a line, however, would practically parallel the existing 13,000-volt transmission line now constructed along the Wabash right-of-way which constitutes part of the transmission line between Lyons and Homer. The construction of this line, which would be in a large measure a duplication of an existing line, would mean a much larger investment, increased maintenance and probably impaired service. The construction of a 13,000-volt transmission line along the hard road, making possible the abandonment of the present line along the Wabash Railroad, would serve the purpose of transmitting energy to Fairmount, Homer, Sidney and adjacent communities, and would also serve the rural consumers."

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Arthur S. Knight, who has recently established offices at Boston as public utility consultant, is well known in central-station and public utility commission circles through his long connection with the Boston Edison company in the field of rates, economics of operation, finance and accounting. Mr.



A. S. KNIGHT

Knight is a native of Boston and entered the employ of the New England department of the Edison company for isolated lighting in 1882 as office assistant. He continued with the Boston agency through subsequent changes until 1892, when he was appointed auditor of the Boston Edison company, later becoming controller. His pioneer work in central-station accounting has influenced the Boston company's practice for more than twenty years. Mr. Knight introduced principles and methods which have since been adopted by other companies, such as what is known as the "replacement theory of handling depreciation," used at Boston for a quarter of a century. Since 1902 he has been retained by the Boston company as a consultant on practically all matters except construction. He was among the earliest to realize the effect of load factor upon rates and to call attention to the defect in the original demand system caused by the failure to give any consideration to the element of size. At the last Edison Association convention he presented a written comment upon power-factor problems in relation to rates. Mr. Knight has specialized in the economic aspects of rate regulation and company administration, investigations for clients involving intricate technical relations, theories and methods, and has played an important part in many commission and court proceedings of public utility interest. He is a life member of the Engineers' Club of Boston and has been on the board of governors since the club began. Mr. Knight is also a member of the Edison Pioneers.

R. T. Long, who for the last thirty years has been a member of the engineering department of the Anderson (S. C.) branch of the Southern Public Utilities Company, has resigned as superintendent of plants and lines to accept a similar position with W. C. Whitner & Company, Richmond, Va. When the first plant of the old Anderson Electric Light Company, containing one 750-light generator driven by steam power, was started in 1890, Mr. Long was its dynamo attendant. Four years later, when the company decided to build its 120-kw. hydraulic plant at High Shoals, Mr. Long was appointed superintendent in charge of its construction. This plant led to the building of the Portman plant, which was started in 1896 under the direction of W. S. Lee, resident engineer. When this plant was placed in operation in 1897, with a total generating capacity of 1,200 kw., Mr. Long was placed in charge. In 1902 he resigned to become connected with the Pacific Gas & Electric Company, but returned to the Portman plant two years later as superintendent. When on two occa-

R. T. LONG

sions the Portman power house was destroyed by fire Mr. Long rebuilt it. In 1913 he was made superintendent in charge of operation of the Greggs Shoals plant and shortly after appointed superintendent in charge of plants and lines.

Murvyn W. Vye, who became vice-president and sales manager of the McKenney & Waterbury Company, Inc., Boston, on March 1, is one of the best-known sales executives in the New England electrical supply jobbing field. He is a native of Randolph, Mass., and entered the electrical field with the old Brockton Street Railway. After two years with that company he entered the purchasing department of the Fore River Shipbuilding Company, Quincy, Mass., and remained with that company for a decade, during the last three years of which he was assistant purchasing agent. In 1909 Mr. Vye joined the sales department of the Wetmore-Savage Company, electrical supply job-

M. W. VYE

ber in Boston. In 1917 he was made sales manager and since then has been a stockholder, director and clerk of the company. Mr. Vye is known throughout the New England territory for his comprehensive knowledge of trade conditions and his imperturbable good nature under stress of business. He is a member of the N. E. L. A.

Victor A. Ryan, who was recently appointed superintendent of the Irvington Varnish & Insulator Company, Irvington, N. J., was formerly production chemist with E. F. Houghton & Company of Philadelphia, and previous to that was connected with the Marden, Orth & Hastings Corporation of Chicago, as well as with the National Oil Products Company of Harrison, N. J., in a similar capacity. Mr. Ryan has been associated with the varnish and textile trades through the manufacture of oils and oil products for the last ten years.

Jacob Bunn, president of the Sangamo Electric Company, and R. C. Lanphier, vice-president, sailed Feb. 26 for London, England, to complete arrangements for the manufacture of Sangamo meters under the name of the British Sangamo Company, Ltd. A factory has been established which will produce both American meters and other designs required on the Conti-

nent. The sales will be handled through the Edison-Swan Electric Company, Ltd., except in Canada and New Zealand. S. B. Rogers, formerly production manager of the Sangamo Electric Company, is in charge of the British works. Mr. Rogers took up his new duties in November of last year.

George Holt Lukes, general superintendent of the Public Service Company of Northern Illinois, who recently died at the Ravenswood Hospital, Chicago, was born in Racine, Wis., Dec. 6, 1869. After graduation from the Massachusetts Institute of Technology in 1892 Mr. Lukes took up the engineering apprenticeship course at the Schenectady works of the General Electric Company and joined the staff of the old Chicago Edison Company as inspector

G. H. LUKES

in 1893. He was made night superintendent of the company about six years later. In 1902 Mr. Lukes left the Edison company to become superintendent of the North Shore Electric Company, with headquarters at Evanston, Ill., and when this company was combined with several others to form what is now the Public Service Company of Northern Illinois Mr. Lukes was made its general superintendent.

A. V. S. Lindsley has been appointed sales manager of the Connecticut Power & Light Company, succeeding B. H. Gardner. Mr. Lindsley is a graduate of Cornell University, where he received the degree of M. E. in 1909. He was with the Westinghouse Electric & Manufacturing Company until 1913, covering both engineering and sales work. He then became power engineer of the Syracuse (N. Y.) Lighting Company, remaining with that organization until 1917, when he enlisted in the United States Army. After serving a year in France as captain of engineers, he received his discharge in July, 1919, and in October of that year entered the employ of the Connecticut company as industrial power engineer at Waterbury, occupying that post until his promotion to sales manager, which became effective Feb. 1.

C. M. Young, superintendent of the power station of the Columbus (Ga.) Power Company, has resigned.

John Kiernan has been elected president of the Douglas County Light & Water Company, Roseburg, Ore., succeeding William Pollman.

R. M. Jennings has been appointed general manager, secretary and treasurer of the Douglas County Light & Water Company, Roseburg, Ore.

A. G. Sutherland has been appointed vice-president of the Douglas County Light & Water Company, Roseburg, Ore., succeeding J. B. Yeon.

J. G. Rollow has become associated with the Los Angeles (Cal.) Gas & Electric Corporation, having resigned from E. I. du Pont de Nemours & Company.

George J. Blanton has been appointed New York district manager of the Chain Belt Company, Milwaukee. For four years Mr. Blanton was connected with the engineering sales department of that company. Previous to joining the staff of the Chain Belt Company Mr. Blanton was for eight years connected with the General Electric Company.

L. C. Peterman, who recently entered the electrical department of Dwight P. Robinson & Company, is a graduate of Ohio State University. He entered the electrical utility field with the Columbus (Ohio) Railway, Power & Light Company, becoming distribution engineer, and later went to the Cleveland Electric Illuminating Company in the same capacity. In 1917 he became connected with the Ohio Utilities Company, Columbus, in charge of substation design and construction on the 40-mile Columbus-Camp Sherman-Chillicothe transmission line. This work included conversion of the steam-driven plant at Chillicothe to a remote-controlled reserve plant and the complete rebuilding of the distribution system. Later Mr. Peterman became electrical engineer for the same company in charge of design and construction of the electric railway and gas properties of the company in Chillicothe, Circleville, Delaware, Hillsboro and Galipolis, Ohio.

George J. Kirkgasser, who has been in charge of sales promotion work, advertising and publicity for the Cutler-Hammer Manufacturing Company, Milwaukee, since 1914, has recently resigned and established an office in Chicago under the name of George J. Kirkgasser & Company. This organization will furnish a service to industrial and engineering concerns in advertising, merchandising and the development of co-operation between works departments, selling departments, outside offices and distributers. Mr. Kirkgasser was graduated in electrical engineering from Syracuse University in 1907 and for three years following this was engaged in engineering work. In 1910 he became identified with the Cutler-Hammer Manufacturing Company as assistant advertising manager and technical writer, a position he held until he was made advertising manager in 1914. Mr. Kirkgasser has contributed many engineering articles to the technical press and is the author of "Electric Light and Motor Wiring," "Electric Control Engineering" and "Motors and Motor Control."

Obituary

Edward B. Hatch, president of the Johns-Pratt Company, Hartford, Conn., died suddenly on Feb. 18. He had been stricken only a few days previous with pneumonia. Mr. Hatch was born in

E. B. HATCH

Hartford, Dec. 20, 1861, and graduated from Trinity College in 1886. Very shortly thereafter he entered the employ of the Johns-Pratt Company in a clerical position, but was rapidly promoted owing to his great energy and executive ability. In 1888, in recognition of work he had already done, Mr. Hatch was appointed secretary of the company. Four years later he was appointed a director of the company and elected president in 1898, succeeding Henry W. Johns of New York, who was the first executive head of the company. Mr. Hatch was not only prominent in the electrical industry but was a director of many industrial concerns and financial institutions. Besides, he was interested in civic affairs of his own city, where the loss of his influence and interest in business and social matters will be keenly felt. It was during Mr. Hatch's administration of the business of the Johns-Pratt Company that the well-known "Noark" line of fuses, switches and meter protective devices handled through Johns-Manville, Inc., developed.

John Mullen, founder of the Shamokin (Pa.) Electric Light Company, one of the first municipal lighting plants in this country, died in that city on Feb. 22.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Possibility of Price Increase on Armored Conductor

THERE seems to be a pretty well-founded opinion among certain jobbers in the East that prices of flexible armored conductor are to undergo an upward revision in the near future. Rumors to this effect have been current for some time, and it is known that manufacturers too have not been unmindful of the possibility of higher prices.

Acting on this supposition, some of the Eastern jobbers reported to a representative of the ELECTRICAL WORLD this week that they are stocking all the armored cable they can obtain. As noted before in these pages, manufacturers will sell at present prices only for immediate shipment, forward orders being accepted at the price in effect on date of delivery. The present market on the whole is quiet both with jobbers and manufacturers.

Questioned regarding the possibility of a higher price going into effect several leading producers admitted that the matter was under consideration at the present time. What action will be taken is, of course, unknown, but the view expressed as representing the manufacturer's standpoint was that production at present prices entails little or no profit. With spring coming on and the prospect of more business developing in the cable market, therefore, it seems logical to believe that prices may increase later on. The current Pittsburgh base price upon which manufacturers are working is reported as $55.

Lower Steel Prices No Help to Higher Production

IN AN endeavor to provide employment for their workers and to work off inventories which have been marked down many independent mills have scaled down steel and iron prices so that the spread of prices between corporation and independent producers is becoming more marked. None the less this cutting has had little stimulating effect on buying. Large and small producers alike are feeling the effect of the buying decline. Even the ordinary run of business that comes from regular channels is being held up.

In virtually every section of the steel country furnace and mill operations are being reduced. Here and there are reports of an improvement in operations, but they are entirely local. At the same time, some independent mills are piling up stocks of iron for reserve. Sheet production is very low and tube production is rapidly declining. The latter fact may have some effect on electrical conduit, as at least one company has just put through a reduction on tubular goods of from $8 to $10 per ton. It is the hope of this producer that the reduction will bring in orders sufficient to run the plant at a little better rate than that existing, which is lower than ever before.

These price reductions in the independent mills have brought iron bars to from 2.70 cents to 3 cents, Pittsburgh, as against a former quotation of 3.06 cents. A cut of $2 a ton under the minimum price of ten days ago, offered on galvanized sheets, brings this quotation to 5.25 cents. The upper price is 5.70 cents. Black sheets can be had at 4.10 cents, a slight recession only from a former minimum of 4.15 cents. But the whole industry is so anxious for trade that it would not be surprising to find recessions even from these prices. Bar, shape and plate prices have held quite level for the last week, the minimum on bars being 2 cents, on shapes 2.20 cents and on plates 2.25 cents. These, it is believed, could also be shaded.

According to Judge E. H. Gary's statement at the February meeting of the American Iron and Steel Institute, steel prices will not be reduced at present, nor is a cut in wages in the steel industry being considered at this time by the United States Steel Corporation. Mr. Gary has had no comment to make so far on the letter from John Skelton Williams, Comptroller of the Currency, wherein Mr. Williams tried to point out the beneficial effects to the country that would result from the lowering of steel prices by the corporation. Even in view of the above it would not be surprising to find not only a reduction in wages but also in steel prices by the corporation in the near future.

Wages, it is generally known, have been very generally reduced throughout the independent steel industry, following which the mills reduced their prices. Consequently any reduction in corporation wages would be expected to presage a reduction in price of finished and semi-finished products.

British Lamp Prices Undergo Reduction

AN ANNOUNCEMENT in the *Electrical Times*, London, says that the Electric Lamp Manufacturers' Association of Great Britain, Ltd., has made substantial reductions in the prices of association makes of the electric lamps as of Feb. 1. These reductions range from about 18 per cent up to 28.6 per cent for the gas-filled type and from 8.3 per cent to 16.7 per cent for the vacuum type.

In the case of the gas-filled lamp the greater reduction of 28 per cent is for the larger size of 100 watts at both the 100-130-volt and the 200-260-volt ranges, while in the case of the vacuum lamps the greater reduction is for the smaller size of 10 watts to 30 watts at the 100-125-volt range.

The report goes on to state that up to the middle of January German lamps were not coming through in any appreciable quantity, but that pressure was bound to be felt sooner or later even with a 12½ per cent duty on exports at the German frontier. The British group of lamp manufacturers, it seems, is preparing to meet this German competition.

Spring Demand for House Meters Not Yet Lively

FROM a survey of the trade which has just been made stocks of the 5-amp. and 10-amp. types of house meters in the hands of jobbers, manufacturers' agents and central stations are quite spotty and range from low to full. Demand, too, is very uneven. In most cases there are sufficient meters on hand to take care of current needs, while reports show that deliveries are improving.

From the Northwest there is a good demand, residence building for the spring being well under way. Stocks are good and replenishments easy. The demand this year is expected to exceed that for several years past. The demand from California has moderated a bit as the result of past shipments, and deliveries are being regularly received again.

In the Intermountain districts there are plenty of meters. Here there is quite an extensive demand for three-wire 15-amp. sizes to handle range loads. The spring is expected to bring in a good call for meters.

Chicago reports a low stock and a light demand, with inquiries at a minimum. But there is a feeling of revival in the building industry. St. Louis has a fairly complete stock of meters, with more of the 5-amp. size. These

nicely balance the demand. There is a steady volume of sales to the rural and small city utilities. The central stations get most of the trade here direct, but jobbers are getting their shipments through satisfactorily.

Agents and jobbers in the Southeast can accumulate small stocks now, but they have only about a one-third normal demand to supply. A revival in business is expected in sixty days. Demand in the Atlantic States is off and stocks are still quite low. It is reported that some manufacturers have not yet supplied all back orders, but deliveries are coming in better. There is still considerable wiring of old houses going on. New England stocks are showing improvement under some rather quick shipments in lots of from fifty to a hundred meters. Demand is holding up well.

Price Reductions Not Yet a Stimulus to Trade

ALTHOUGH reductions in price of electrical supplies employing in their make-up large relative amounts of cotton and copper and some steel products were made before the past year came to a close, it was not until early in February that general reductions applied to electrical apparatus and equipment gave to the industry the evidence of a downward trend in prices that it had been looking for. Since that time, however, manufacturers of virtually all classes of motors, generators, control, transformers of the distribution type and other kinds of apparatus, both mechanical and electrical, as used in the power transmission and utilization field, and of items of supply and equipment, have experienced a reduction in price of approximately 10 per cent. The lower limit is in general 5 per cent, and it runs up to about 20 per cent on some items. At the same time former inquiries have been refigured, old prices giving way to substantially lower quotations.

Since the first of the year manufacturers producing for the electrical field have felt the seriousness of the hesitation in buying and have found it imperative to lower their working hours per week, or to curtail their working forces, or to make cuts in their wage scales. In many instances combinations of these expedients have been found necessary. As a result the manufacturers have revised their prices downward, thereby keeping faith with their workers in the matter of the reduction of wages and production.

But there has been no evidence of any resumption in buying. Here and there will be found new business, but much of the activity is still that of maintenance. However, the electrical industry is a basic one in the industrial and commercial life of the nation and the world, and it can be only a matter of time when all the work which is being left undone must be done. Then much of the equipment will be demanded in a hurry, and the producer with stocks will get the call. Raw materials now are low in price, and much electrical equipment is appreciably lower than it was the first of the year. Labor is plentiful, and producing capacity is ready to handle a large volume; but the starter with the gun is still slow in coming up to the line.

India Seen as a Market for Electrical Materials

THAT India has a bright future in the electrical field is very well shown from reports which have recently been brought back by a representative of one of the largest electrical manufacturers in the United States. Much of this optimism for the future, to be sure, is predicated on the stabilization of economic conditions in that eastern country. It has been asserted that, given a chance to grow —a chance to develop economically, socially, politically— India within ten years will become a very important factor in the progress of Asia and will be both a large industrial consumer and a large industrial producer. But if the conditions are reversed and the country is fettered economically, socially and politically it will go down hill fast.

India contains a number of water-power resources, some of which already have been developed. Virtually all the hydro-electric equipment recently installed, it is stated, is of American manufacture, and, as a matter of fact, the electrical apparatus in India includes a large quantity of American make. On the other hand, English wiring materials predominate because of the rulings of the installation code which permit of the use of materials manufactured in that country. These are in general said to be of a grade below the highest.

Exports of electrical materials and apparatus of all kinds from the United States to British India during 1920 amounted to approximately $4,250,000. There are great possibilities for electrification in the oil fields, in the mines, for agricultural work and in the industries. Besides, the natives are good users of electricity for light. Considerable jealousy and a spirit of competition among individuals and communities in respect to illumination have been found to exist. Consequently a field for electric signs and a need of illuminating engineers have been reported. There is some use for socket devices, but native cooks are cheap and wood for fuel is plentiful.

Besides the prospect of electrification of the oil fields, there is already a big development in the steel mills. The mica, copra, shellac and jute industries are some of the most important in India, while shipping plays a big part. Much raw material, especially cotton, is shipped to England to be fabricated and returned. Textile mills in India would provide an outlet for native labor. This is only one instance of the lack of finishing mills in India, but the opportunity for them is regarded favorably. The use of electricity in shipping provides still another outlet.

The Metal Market Situation

THE tone of the copper market is again easier, prices being fractionally lower than they were a week ago. Domestic demand remains light, but it seems that the lack of buying interest is not especially a question of price. In fact, copper at the present price is considered a good buy, but until the demand for finished copper products increases materially wire drawers, brass manufacturers, etc., will probably continue to purchase only for immediate needs.

Some small amount of copper for prompt shipment is reported to have been sold at 12.50 cents per pound delivered by producers, whose quotations for the second quarter range from 12.75 cents to 13 cents delivered. The outside market has reduced its prices in accordance with the drop in the major market, but there is little if any copper in dealers' hands at lower than producers' prices. Standard spot copper at London developed a weaker tone during the past fortnight and by successive drops fell £4 to £68 5s. per ton.

The market for zinc continues sluggish, and spot fell off another fraction of a cent the past week. The price of lead has been cut to 4 cents per pound by the leading interest, but as yet legitimate buying interest has not reacted strongly, though the speculative element in buying is more pronounced in view of this new low price.

NEW YORK METAL MARKET PRICE

	Feb. 28, 1921	March 1, 1921
Copper	£ s d	£ s d
London, standard spot	72 5 0	68 5 0
	Cents per Pound	Cents per Pound
Prime Lake	13.25	12.75
Electrolytic	12.50—12.75	12.50—12.62½
Casting	12.37½	12.00
Wire base	15.75	15.25
Lead, trust price	4.40	4.00
Antimony	5.20	5.20
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	11.00	11.00
Zinc, spot	5.30	5.10
Tin	32.50	30.25
Aluminum, 98 to 99 per cent.	28.00	28.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	10.75–11.25	10.50–10.75
Brass, heavy	6.00– 6.50	6.00– 6.50
Brass, light	4.00– 4.50	4.00– 4.25
Lead, heavy	3.75– 4.00	3.25– 3.50
Zinc, old scrap	3.00– 3.25	3.00– 3.12½

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

IT IS at least satisfying that the supply business is getting no worse than it has been. Reports from the different sections of the country give no assurance that business is any better, but they show that it is holding its own. The Northwestern States alone show an increase in trade. Here, it seems, the spring building is already under way, and February is shown to be ahead of January in sales made.

New price reductions are given on outlet boxes, cable boxes and switch boxes and on some small socket devices such as vibrators, drink mixers, etc. There may be an advance in armored conductor.

Stocks are being kept only large enough to meet present demand as a whole, and that means only a slow movement from manufacturers and jobbers. There's no difficulty reported in getting fresh supplies rather quickly from the factories. Collections show no change except that they are possibly a little easier around St. Louis

NEW YORK

Little if any actual change is evidenced in trade. It appears that the return of business has thus far been slower in its progress than had previously been expected. However, there has at least been no further recession in sales, and the general opinion prevails that the industry reached rock bottom some time ago. One or two houses that have consistently reported fairly good sales continue to assert that business is good, but several others, though optimistic in tone, are not experiencing much actual increase in demand as yet.

Price reductions on outlet boxes, switch boxes and cable boxes have recently been put into effect by manufacturers. There is a feeling among several jobbers here that schedule material manufacturers are holding up the movement of supply lines by not reducing prices. There are also pretty strong rumors that flexible armored conductor is due for a price increase before long.

Contractors are buying but sparingly, and apparently they do not have a large amount of work actually in prospect yet. There is a fair amount of business coming from isolated plants, however.

Rubber-Covered Wire.—Demand continues light, but stocks are at a fairly low level on the whole. No. 14 in 10,000-ft. quantities is quoted this week from $8 to $8.50 per 1,000 ft.

Schedule Material.—Except for occasional overstocks jobbers' supplies are fairly low. There seems to be a strong opinion in several quarters that prices are too high and must come down. Consequently buying is from hand to mouth. Manufacturers, however, state that immediate price reductions are not possible.

Lamps.—Lamp sales are holding up well, business in this line being much more favorable than general supply items. Shipments are good and stocks are well built up.

Dry Cells.—Sales, though fair, are not extra large, rather below normal if anything. The supply is good and prices are unchanged, No. 6 in barrel lots being quoted at 36 cents each.

Flexible Armored Conductor.—Demand, with a few exceptions, is light. Stocks are not large, but there is some tendency to stock up in view of rumors of price increases. No. 14 two-wire double-strip in 1,000-ft. lots is generally quoted around $65.

Outlet Boxes.—Sales are not active, and the supply is plentiful. An increase of five points in the discount on boxes, amounting to a price decrease of about 7½ per cent, is announced by several manufacturers, effective the latter part of last month.

Small Socket Devices.—A price decrease of 15 to 20 per cent on vibrators, hair driers, drink mixers, sewing machine and other small motors, etc., has been announced by the Hamilton Beach Mfg. Company, effective Feb. 15.

Conduit.—Several jobbers report active sales in small lots to isolated plants especially, though others state that demand is very weak. Stocks are generally at a favorable level. In 2,500-ft. quantities ½-in. black can be bought from several jobbers for $67 to $68 per 1,000 ft., though prices considerably above this are asked in some quarters. One-inch black quotations range all the way from $131.50 to $155 per 1,000 ft.

Cable and Switch Boxes.—Prices of cable and switch boxes are reported to have been reduced the latter part of February by several manufacturers. The only ones that have actually confirmed a drop at this writing are the National Metal Molding Company, effective Feb. 21, whose cable boxes, formerly listing at 22 cents each, now take a 25 per cent discount, and the Chicago Fuse Manufacturing Company, effective Feb. 23, whose switch boxes were reduced about 10 per cent. Other manufacturers who have not already fallen in line are expected to do so soon.

CHICAGO

While the entire electrical industry remains in a state approaching stagnation, an observer of business in general sees unmistakable signs of a gradual resumption of activity in various lines, notably construction. A marked increase in the number of building permits issued is noted. Last week's figure of $1,000,000 included over fifty dwellings and apartments, and this week's $1,500,000 covered a widely diversified assortment of small buildings and medium-sized apartment houses. The gradual resumption of industry in the Detroit district promises work for the auto-accessory people, and each one of these tendencies can be seen to have an indirect bearing on the trade in electrical goods.

Bare Copper Wire.—Recent fluctuations in the copper market have failed to have any effect on quotations on bare copper wire, $18.50 per 100 lb. still being the quoted figure on small lots of No. 8. In car lots $17 is named.

Insulated Wire.—Base is unchanged on all styles. Present price on No. 14 rubber-covered is $7.85 and $8 per 1,000 ft., depending on quantity, lower figures being available in carload lots. Weatherproof, on a 19-cent base, is 20½ cents per pound for No. 8 triple-braid in 500-lb. lots and 20 cents for No. 6. These prices are subject to variation by different jobbers, all being willing to transact any business which will show a reasonable profit.

Conduit.—Business in black conduit is confined largely to inquiries, reported fluctuations in the iron trade causing prospective buyers to feel like delaying purchases in the hope of obtaining better figures. Half-inch conduit is quoted, in 5,000-lb. quantity, at $64 per 1,000 ft., this price being subject to cutting by some of the smaller interests.

Flexible Armored Conductor.—There is a fair amount of trade at the prevailing figure of $62 per 1,000 ft. in 5,000-ft. lots.

Knobs and Tubes.—Stocks are reported as being ample to supply all calls, and business, especially from out of town, is good. Split "Nail-it" knobs in barrel lots are $32 per 1,000. Tubes, 3 in. x $\frac{5}{16}$ in., are $10.50 per 1,000. These prices are firmly held.

Sockets.—The great amount of alteration work that has been done this winter has kept demand on sockets lively, and trade remains good up to the present time. Quotations from ample stocks are, for keyless, 24 cents; key, $26.40, and for pull chain, 48 cents. These prices are for original package lots.

Tape.—Stocks in both dealers' and jobbers' hands are spotty. All have some goods on hand, but any real demand would send purchasers scurrying to the factory with rush orders. The present quotation on rubber tape in 100-lb. lots is 92 cents per pound; in less quantities, 97 cents. Friction tape is similarly quoted at 73 cents and 81 cents. These quotations are for the highest grade.

BOSTON

Business shows little change from week to week. Jobbers' stocks are meeting current demands easily, and buying from manufacturers is moderate, small orders predominating. Collections require close attention. Prices are easier on outlet boxes and non-metallic flexible conduit. Deliveries are prompt in virtually all lines. Manufacturers are filling many back orders for electrical products, and in the textile and leather industries improved conditions are evident. The Boston building-trades strike continues to curtail buying, but in New England as a whole building and engineering contracts for the week ended Feb. 22 totaled $2,796,300, reflecting some betterment of conditions. A good deal of quiet, steady buying by central stations is going upon the ledgers of jobbers and manufacturers.

Motors.—On account of the present moderate demand stock shipments can be secured easily, though not in all standard makes. Recent price drops do not appear to have stimulated much new business, though inquiries are active. The market for second-hand motors is dull.

Electric Ranges.—Manufacturing for stock is going on steadily in anticipation of the spring demand. Prices are sluggish. A good business is expected this year. Raw material is plentiful now, and at least one representative producer is operating with a practically unchanged wage scale five to six days a week.

Wire.—Rubber-covered wire is moving slowly with ample stocks. No. 14 sold at $8.75 in Boston Monday in 5,000-ft. lots. Weatherproof No. 8 sold at 26.5 cents per pound in 100-lb. to 200-lb. lots. Bare copper wire was bringing 16.5 cents per pound early in the week, with moderate demand.

Non-Metallic Flexible Conduit.—Easier prices rule, the ½-in. size selling around $22 per 1,000 ft. and the ⅜-in. at $24, both in 5,000-ft. lots. Demand is off.

Knobs and Tubes.—"Nail-it" knobs were selling Monday for $27 per 1,000 in barrel lots and 3-in. tubes at $11.35 per 1,000 in barrel lots. Good stocks of porcelain are now reported, but glass insulators are scarce.

Flexible Armored Conductor.—Prices are unsteady, No. 14 double-strip bringing around $60 to $65 per 1,000 ft. in 5,000-ft. lots. Stocks are liberal and the volume of business small.

Appliances.—Not much activity is apparent beyond staple sales, which are yielding a fair business in old-established lines and makes. Merchandising departments of central stations and other retailers are showing considerable life, however, and a good spring trade is looked for. Renewed attention is being given to intelligent salesmanship and service to the customer.

ATLANTA

Reports from jobbers indicate little or no increased activity on the part of the contractor or dealer, spring buying having as yet not made itself evident. Buying by industrial plants mentioned a few weeks ago has disappeared, and orders do not continue to hold up as indications seemed to promise in the earlier part of the month. Present conditions, however, have not created a spirit of pessimism among the more prominent jobbers. They feel certain that the advent of spring weather cannot help but bring with it orders from the industrial and retail trade, stocks having reached a low ebb from lack of buying. The shortage of homes is still acute in most of the Southern cities, though there is an increasing number of vacant commercial buildings. Office space, however, remains scarce. Home building will undoubtedly start as soon as weather conditions will permit.

Bank clearings in the principal Southern cities continue to run about 35 per cent below those of last year, but credit men report credit conditions as slightly improved.

Panelboards.—There has been little new business in panelboards in the past few months, but fill-ins and jobs being completed have tended to keep life in this line. Prices remain steady, and promises on shipments from factory of standard equipment have been materially reduced.

Oil Switches.—There is very little oil-switch business in the larger sizes, and the small business that is coming in is mostly from jobs being finished in the textile field.

Washing Machines.—After a protracted period of apathy in the appliance field, especially in the higher-priced articles such as washing machines, the tone is considerably improved and a slight increase in sales is noted this week. This will be further stimulated by the fact that one of the largest washing-machine manufacturers is running an intensive campaign in Georgia. Dealers have been looking forward to a reduction in the price of washing machines, but indications at present do not point to any appreciable change soon.

Air Heaters.—The sale of electric air heaters during the winter has been a keen disappointment to every one, and indications are that large stocks will be carried over. This is no doubt because this section had a very mild winter and the final users have not purchased appliances of this nature as freely as was the case last year.

Power-Pole-Line Switching Equipment.—Jobbers report business in this line picking up and better than for some time past. Stocks are in excellent shape and shipments are coming through promptly.

Farm-Lighting Outfits.—The increased movement reported several weeks ago remains about the same, though inquiries are coming in in greater volume. Stocks of large and medium sizes are rather low but plentiful in the smaller sizes. Shipments are reasonably prompt.

Fans.—Though it is a little early for much activity in this line, orders are reported in fair volume. Stocks are in satisfactory condition with shipments unusually good. A price reduction of 10 per cent was announced two weeks ago.

Lamps.—Sales are very good and will be further stimulated by the merchandising conference held in Atlanta in the past week. Stocks are in excellent shape and shipments are all that could be desired.

ST. LOUIS

Sales continue in sufficient volume to prevent discouragement on the part of jobbers, though they are not doing much ordering in turn from the manufacturers. Those manufacturers who sell direct report a fair amount of business. Demand for all items has been considerably stronger all through February than it was during January, and orders filled will probably run from 10 to 15 per cent over the previous month. The market has become more competitive than it has been for a long time, and price is the considered factor in most sales. This applies particularly to porcelains, upon which quotations vary, though all of them are still below replacement prices. Power sales have decreased, but they are still much higher than was the case two years ago. Jobbers report a good demand from small utilities through Missouri and the outlying trade territory of St. Louis to the Southwest. Numerous sales of lightning arresters to these utilities are a feature.

Employers of workmen in the building trades have prepared new blanket contracts calling for a 15 per cent cut in wages and are holding conferences with the men. If the contracts are accepted, many buildings will be started immediately. It is estimated that 50 per cent of the men in the building trades are out of employment at present.

Collections have become easier. The average is still around sixty days, but credit departments are not forced to work so hard. Some jobbers and manufacturers have notes and trade acceptances on their hands, but these are being liquidated as they come due.

Construction Tools.—Most jobbers keep part of their stock for use in emergencies on a rental basis. Just at present supplies of tools for sale are spotty, but jobbers report that they can replenish their stocks easily if demand quickens.

Wire.—Sales of weatherproof wire have picked up during the week, and jobbers have been moving fairly large quantities of the Nos. 6, 8 and 10. The market is extremely competitive, but quotations are nominally on the 18-cent base. Quotations on rubber-covered wire are showing more firmness, the lowest price during the week being $8.10 per 1,000 ft. of No. 14, in 5,000-ft. lots. Demand has dropped off to some extent. The market for magnet wire is practically dead, manufacturers having enough on hand to take care of their requirements for some time. It is quoted on the 18-cent base, while bare wire is quoted around 15½ cents.

Lamp Cord.—There is a fair movement here, with fixture manufacturers taking small quantities of the silk-covered cord. The cotton lamp cord is selling fairly well in a very competitive market. No. 18 twisted silk lamp cord is quoted at $33.45 per 1,000 ft. and the cotton cord at $17.50 per 1,000 ft., both in small quantities.

Rigid Conduit.—Demand was off against last week, and prices have been lowered in order to move stocks, which continue large. The ½-in. black is quoted around $65 per 1,000 ft., with the ¾-in. size priced in some instances as low as $73.

Schedule Material.—Price concessions have increased the demand to some extent, but stocks are not moving satisfactorily yet. Quotations of all jobbers are below those of manufacturers.

Washing Machines.—A large increase in the sale of washing machines has been noticeable during February. Some jobbers estimate that their February business in washing machines increased 100 per cent over that of January. Dealers report that the public is becoming convinced that it will not save much by waiting several months for prices to come down.

Vacuum Cleaners.—Demand has fallen off somewhat, and dealers are not ordering heavily from jobbers. Stocks are good.

SALT LAKE CITY—DENVER

The price tendency in electrical merchandise is downward. Rough lumber has had a decline of from 40 to 50 per cent, while finished lumber remains at a figure that makes building difficult. Some jobbers are suffering from overstocks in many electrical lines as the result of having pyramided orders last year. Jobbers who are not competent to forecast the future expect a big industrial expansion within the next six months. That there will be several more slow months in the meantime, however, is the general opinion.

The purchasing power of Intermountain farmers is at a low ebb, with no immediate prospect of alleviation. Stocks in nearly all lines are more than ample. Deliveries are excellent. Orders can be filled from Eastern factory centers in from fifteen to twenty days. The volumes, however, are from 20 to 40 per cent below normal, indicating a rather sluggish condition of the market. Collections are slowly improving.

Distributing Transformers. — Jobbers are plentifully stocked and looking forward to a good market after the beginning of the spring season. A price recession of 10 per cent has been noted.

Farm High-Tension Switches.—An accurate canvass of the territory revealed the startling fact that 95 per cent of the possibilities within reach of electric service are now connected. This means that the potential field for installing farm lighting and power plants is relatively small in this immediate territory.

Ranges.—The power companies have all placed large orders with their manufacturers, indicating their confidence in spring and summer business. The present stocks are good. There is some intimation in the trade of a fall in the prices.

SEATTLE—PORTLAND

Both jobbers and retailers in the Puget Sound district assert that business during February was in excess of that transacted in January this year or during February last. In fact, the past month, on account of weather conditions which permitted building construction without inconvenience, was unusual in many ways. According to every indication spring has arrived in this section and seasonal activities have begun. Stocks, with but one or two exceptions, are in excellent condition and replenishments are easy to obtain. The lumber mills and logging camps are gradually reopening and conditions are getting back to normal.

Jobbers in the Portland district report a material improvement in business. A slump in domestic appliances was offset by a greater activity in pole-line materials in February. Bare copper wire is the cheapest thing on the market at the present time. Insulated wires have also decreased in price. Lamp cord can be purchased one-third cheaper than it could last August. The urgent need of construction work, the announced drop in prices of many steel products and the prospects of a reduction in wages all point toward early activity in construction lines. Manufacturers report business quiet.

Ranges.—Sales in this territory, generally speaking, are languishing owing to prevailing high prices and costs of wiring. Stocks, both of jobbers and of central stations, are in good shape, but prices are holding firm and high. Both jobbers and central stations report numerous inquiries and prospects but state that business will not materialize until prices show considerable decrease.

Schedule Material.—Owing to an increasing amount of residence and business construction throughout this section this line of merchandise is showing a comparatively healthy movement, although sales are still below normal. Stocks are in fine shape and shipments are coming through entirely satisfactorily. Prices have declined from 1 to 5 per cent.

SAN FRANCISCO

Business conditions in general are mending very slowly. In fact, the month of February may be said to close with a more pessimistic note than that with which it began. Collections, however, are not much slower than usual, though they require vigilant following. New credits are being very cautiously extended. Electrical dealers who are availing themselves of the services of banks and financial agencies for carrying their customers on house appliances find that each contract and its references must be giltedged.

Ranges.—The delay in supplying new power, the conservation of present power for irrigation loads and the general attitude of the purchasing public have resulted in disappointing range sales for the year and the expectation that these conditions cannot improve within the next few months. It is reported that local jobbers have requested their factories to cancel several range carload orders. On the other hand, the campaign of education is being maintained and occasional demonstrations are being given by dealers.

Schedule Material.—Business is better than during the three previous months but is below the February, 1920, showing. On the other hand, just as the local steel people, in the face of decreasing business, are placing big Eastern orders so as to be ready for the building boom when it does arrive, so there is a disposition to accumulate schedule stocks for the same emergency. A feature of the February business has been an enormous sale of pull sockets, the bulk of the shipments going to southern California.

Household Devices.—There has been recently a series of bitter complaints among the electrical dealers over the profit margin allowed them on electrical appliances. This has been accentuated by falling business precluding the possibility of maximum quantity purchases to secure maximum discounts. A general sifting of overhead and other statistics is the result, in order to secure authoritative data for formal complaints to jobbers and manufacturers. The situation is not yet clear, but is being followed.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Mitchell-Rand Takes on Ebony Asbestos Wood Line

Mitchell-Rand Manufacturing Company, 18 Vesey Street, New York, is distributing in the New York territory ebony asbestos wood for switches, panels and bases manufactured by Johns-Manville, Inc. A good assortment of stock will be carried in the company's warehouse to insure quick deliveries.

Supply Jobbers' Association's Publicity Campaign

In connection with its campaign of publicity the Electrical Supply Jobbers' Association has been following through a pretty vigorous line of advertising. The campaign began last September and will run through December, 1921. With the publishing of announcements of new electrical products by manufacturers, the questions arise in the buyer's mind: "Is this what I want?" and "Where will I get it?" The association answers these questions in its publicity matter by the slogan: "Ask your electrical supply jobber."

Sixteen months of advertising in the electrical trade papers covering the entire electrical field, 150,000 illustrated folders, 50,000 booklets, 3,000 plan books and broadsides, 15,000 letters to jobbers' salesmen, accompanied by exhibits, and 1,500 letters to association members, also accompanied by exhibits, will cover the scope of the campaign.

Brandywine Fibre Products Space Enlarged

In more than doubling its capacity in floor space and trebling it in equipment, the Brandywine Fibre Products Company, Wilmington, Del., announces that it is now in a better position than ever before to take care of hard vulcanized fiber tubing and standard mill lengths or parts machined to order.

Profit Sharing and Copartnership at the Blaw-Knox Works

With the reduced working schedule at the works of the Blaw-Knox Company, Blawnox, Pa., there are 449 men employed in the shops. Of this number 391 are stockholders. The amount they have invested totals $168,000. In addition to this the shop foremen own $56,000. There are 204 men and women employed in the general and district offices, and they have invested $400,000. Including the officers and the heads of the company who are actively engaged in the business, the investment of the entire group amounts to about $2,000,000, or 60 per cent of the entire outstanding capitalization, which is $3,417,825.

Japanese Engineers Visit Salt Lake

T. Nishioka and M. Nakamura of the commercial engineering department of the Tokio Electric Company, Ltd., Kawasaki Kanagawaken, Japan, were recent visitors in Salt Lake City. The company which these men represent is the Japanese branch of the General Electric Company, and their visit to America is for the purpose of obtaining new ideas in connection with the commercial branch of the industry.

Electrical Equipment Sales by War Department

Electrical equipment to the extent of $1,697,072 was sold as surplus property by the director of sales of the War Department prior to Jan. 1. This does not include electrical equipment transferred or sold to government departments or agencies.

Howell Motors Company Increases Distributers

In line with its policy of producing motors for national stock, as recently noted in these pages, the Howell (Mich.) Electric Motors Company has rapidly increased the number of its distributers. The latter now cover about twenty-four of the most important cities in this country and Canada, Howell motors being stocked in these cities. A complete list of the company's distributors follows: Electrical Machinery Sales Company, Chicago, Milwaukee and Minneapolis; W. L. Veit, Philadelphia; Carl Johnston, Grand Rapids, Mich.; Garland-Affolter Engineering Company, San Francisco; L. M. Sperry, St. Louis; H. J. Wittman, Toledo; Ohio Machine & Motor Company, Cleveland; D. W. Smith, New York City; A. H. Keleher (export for South America), 44 Whitehall St., New York City; Export office, 90 West Street, New York City; J. E. Hoffman, 280 Carolina Street, Buffalo; L. B. Gottschall, Dallas; Electric Supply Company, Saginaw, Mich.; Sperry & Pittner, Pittsburgh; Electric Motor & Machinery Co., Ltd., Montreal, Que., and Toronto, Ont.; Southern Electric Supply Company, Atlanta; Virginia Machinery & Well Company, Richmond, Va.; E. & M. Products Company, Boston; J. R. Purser, Charlotte, N. C.; Intermountain Sales Company, Denver; Machinery & Electrical Supply Company, Winnipeg, Man.; Power Machinery Company, Kansas City; W. W. Fraser, Vancouver, B. C.

Manufacture of Pelton Furnace Line Resumed

Announcement is made by C. R. Pelton, president of the Pelton & Crane Company, Detroit, that the company has resumed the manufacture of the Pelton electric furnace line, which was discontinued in 1916 when it was not possible to obtain certain materials necessary to the manufacture of the furnaces on a standard of past quality. Moreover, platinum had advanced in price to a point which made the furnace price too high to obtain a profitable volume of production. The furnace and pyrometer lines are intended primarily for use in the dental profession.

Carter Electric's Merchandising Conference

The merchandising conference of the General Electric Company and its subsidiaries, in collaboration with the Carter Electric Company, held in Atlanta on Feb. 21 and 22, proved a big success, especially as regarded attendance by contractor-dealers throughout the state.

The Carter Electric Company initiated dealer conferences of this nature four years ago, and it is interesting to note that there were twenty-five present at the first meeting and forty and sixty respectively at the second and third meetings, while actual signed attendance cards showed that 238 people attended the recent conference. All those attending were enthusiastic over the outcome of the conference, and many dealers have already requested the Carter Electric to take up with the General Electric Company the rearrangement of their stores.

Lighting Fixture Manufacturers Re-elect Officers

The National Council of Lighting Fixture Manufacturers at the close of its convention and market in Buffalo, the third week in February, re-elected Fred R. Farmer of Chicago as president, William Horn of Philadelphia as vice-president and Charles H. Hofrichter of Cleveland as secretary-treasurer.

Government Seeks to Dissolve Southern Pine Association

The United States government on Feb. 21 filed injunction proceedings in the federal court against the Southern Pine Association, sixty-one corporations and sixty-nine individuals, in an effort to end an alleged conspiracy to curtail the supply and increase the price of yellow-pine lumber.

The suit charged violation of the Sherman anti-trust law by the association and asked for a preliminary injunction to restrain it from recom-

mending or suggesting curtailment or restriction of production of yellow pine "or measures or acts tending to result in such curtailment or restriction."

This is a suit similar to that instituted against members of the American Hardware Manufacturers' Association, as discussed on page 100 of the July 10, 1920, issue of the ELECTRICAL WORLD.

Westinghouse Builds Experimental Laboratory for High Voltages

Recent advices from the Westinghouse Electric & Manufacturing Company state that owing to the trend toward higher voltages which is being initiated in the West and which will ultimately extend to all parts of the United States the Westinghouse company is building a complete, modern, high-voltage experimental laboratory. In this laboratory will be installed two transformers, one rated at 1,000,000 volts, 1,000 kva., the other rated at 500,000 volts, 500 kva., which can be connected to give 1,500,000 volts between terminals.

The laboratory will be 120 ft. long, 110 ft. wide and 50 ft. high, without columns of any sort. High-voltage insulators, transformer terminals and circuit-breaker terminals will be tested in this plant.

Apex Puts on Sales Contest

A nation-wide sales contest is being arranged by the Apex Electrical Distributing Company, Cleveland, in connection with the sales of its Apex electric suction cleaners, according to an announcement made by R. J. Strittmatter, sales manager. The contest began Feb. 19 and will close on the last day of March, after which prizes will be awarded to those making the best sales showing during the competition.

Crawford Motor Changes Hands

The William B. Durgin Company, manufacturer of Crawford motors at Concord, N. H., has been purchased by L. E. Wooton Company, Inc., New York City, the sole selling agent for Crawford motors. The new company has been reorganized and incorporated under New Hampshire laws with the name of Crawford Manufacturing Company, at a capitalization of $150,000. L. E. Wooton is president, J. J. Crawford vice-president, P. L. Gill treasurer and R. L. Blanchard secretary. Mr. Crawford was superintendent under the old company and Mr. Blanchard assistant superintendent. They will both remain at the Concord plant, while Mr. Wooton and Mr. Gill will make their headquarters in New York. The William B. Durgin Company has been manufacturing motors for its own use for the past seven or eight years, and after the war began the commercial manufacture of polyphase induction motors of ¼ hp. to 15 hp. was undertaken. The plant at present has a capacity output of about 300 to 350 motors per month with a sales value of approximately $30,000. The existing sales policy, motor design, etc., will remain unchanged, it is announced.

National Chain Buys Larger Factory in New Jersey

The National Chain Company, College Point, Long Island, N. Y., has purchased a building at Belleville, N. J., which will be remodeled as a factory for the production of chain for lighting fixtures. These new quarters will comprise about 30,000 sq.ft. of space, part one-story and part two-story, increasing the former factory capacity about two-thirds. Occupancy is expected about May 1. A resident sales branch will be established in Chicago soon. The company has just developed a real brush-brass finish on steel-plated chain, according to C. W. Smith, treasurer and sales manager, and a new "jap" bronze-plated finish.

More Space for Riddle Fixtures

The E. N. Riddle Company, Toledo, Ohio, has bought and remodeled an old hotel on Fourth Street and is now occupying it for the manufacture of lamps and lighting fixtures for residential use only. The new factory takes in 80,000 sq.ft. of working space, which is about three times that of the former factory on Broadway, Morris and Ottawa Streets. The company gave up the production of a glassware line during the war and is concentrating on the candelabra and candle-type designs.

Cutler-Hammer Increases Quarters for Clutch and Magnet Department

The Cutler-Hammer Manufacturing Company, Milwaukee, has transferred its clutch and magnet department from the main works in Milwaukee to a plant recently acquired in West Allis, Wis. This addition increases the total floor space by 100,000 sq.ft. The building housing the shops and office is 300 ft. x 300 ft. and is equipped with machinery for the manufacture of the various products of the department, including electric shoe brakes, lifting magnets, magnetic clutches, etc. A portion of the plant is devoted to making punches for the motor controllers put out by the main plant in Milwaukee. This branch plant employs between 250 and 300 persons and maintains a cafeteria and hospital on the grounds. B. T. Foote, formerly of the engineering department at the main works and later manager of the Boston district office, is manager of the new plant.

American Electric Vehicles Pushed in India

H. B. Stimpson, who was formerly the Boston district manager for the Milburn and Detroit electric pleasure cars and the Ward electric commercial truck, is now in Calcutta, India, to assist in opening up the market in that country for American electric vehicles and to impart American standards of sales and service. Mr. Stimpson is serving in the capacity of general manager of the Transit Engineering Company, Ltd., a British firm which has been organized especially for handling the Milburn and Detroit cars and the Ward truck. The agency for the Wotton electric charging apparatus, manufactured by the Electric Products Company of Cleveland, has also been secured.

McKenney & Waterbury Company Changes Hands

The McKenney & Waterbury Company, Boston, Mass., has been purchased by Murvyn W. Vye and Alfred J. Paine and since March 1 has been doing business under the name of the McKenney & Waterbury Company, Inc., wholesalers and retailers of lighting fixtures and supplies. This house is one of the oldest in the East, having been in business nearly three-quarters of a century. It is said that the first kerosene lamp marketed in Boston was handled by the founder, a member of the McKenney family. It has been conducting business for thirty-three years at its present site at Franklin and Congress Streets, and its slogan, "We Light the World," is known from coast to coast.

The Cleveland Electric Motor Company, 5213 Windsor Avenue, Cleveland, announces that D. Wilson, formerly sales manager for the Electro Dynamic Company, has returned to Philadelphia and will become associated with Harris & Evans, Real Estate Trust Building, in the distribution of the products of the Cleveland Motor Company.

The Runzel Lenz Electric Manufacturing Company, 1751-55 Northwestern Avenue, Chicago, manufacturer of lamp cords and wire annunciators, is considering the construction of a two-story factory, 50 ft. x 60 ft., to cost about $20,000.

The Celluloid Zapon Company, 200 Fifth Avenue, New York City, manufacturers of lacquers, insulating varnishes, lamp frostings, etc., announces the opening of its Philadelphia office at 520 Walnut Street, in charge of B. O. Clausen.

The Cincinnati Electrical Tool Company, Freeman Avenue, Cincinnati, Ohio, has been authorized to increase its capital stock from $75,000 to $225,000. The company, it is stated, does not contemplate any immediate extensions.

The Wunder Ice Machine & Refrigerating Company, Cincinnati, Ohio, has been authorized to increase its capital stock from $25,000 to $100,000. No definite plans, it is understood, have been made for extensions.

The Mar-Sla Manufacturing Company, Youngstown, Ohio, recently organized and with a plant at Hubbard, Ohio, will deal in chemically treated switchboards.

The Crane Company, 836 South Michigan Avenue, Chicago, is having

plans prepared for the erection of a two-story and three-story machine and repair plant on property recently acquired on Twenty-fourth Street, Pittsburgh. A six-story warehouse building, 72 ft. x 90 ft., will also be erected. The cost of the buildings, including equipment, is estimated at about $500,000.

The Wagner Electric Manufacturing Company, St. Louis, announces the removal of its Boston office and service station to 342 Newbury Street, where it will occupy the entire building. Brooks Faxon will continue in charge as district manager.

The American Insulator Corporation, New Freedom, Pa., announces the appointment of the Albert J. Cox Company, 564-570 West Monroe Street, Chicago, as its sales representative in the States of Illinois, Indiana, Missouri, Iowa, Minnesota and Wisconsin. The Albert J. Cox Company will handle the "Aico" line of products, consisting of cold-molded insulating parts for electrical and automotive units.

The Packard Electric Company, Warren, Ohio, manufacturer of transformers and starting, ignition and lighting cable, has moved into its new quarters in the Printers' Crafts Building, 461 Eighth Avenue at Thirty-fourth Street, New York City. J. E. Erickson, manager for the New York district, is in charge.

The Cutler-Hammer Manufacturing Company, Milwaukee, held a general sales meeting in Milwaukee from Feb. 14 to 19, which was attended by the office managers of the several district offices of the company. W. C. Stevens, sales manager, was in charge.

The Hazard Manufacturing Company, Wilkes-Barre, Pa., manufacturer of wire rope and electrical wires and cables, has opened a new sales office and warehouse at 1701-1703 First Avenue, Birmingham, Ala., in charge of R. J. Bravard, district manager.

Stuckeman Brothers, 18 Ruth Street, Pittsburgh, Pa., manufacturer of small motor-driven air compressors and other specialties, has recently been incorporated with a capital stock of $50,000, in order to facilitate expansion along other lines. W. F. Stuckeman is president.

The Jeffrey Manufacturing Company, Columbus, Ohio, manufacturer of coal-mining machinery, electric locomotives, elevating, conveying and crushing machinery, announces the removal of its Denver (Col.) office from the First National Bank Building to 421 United States National Bank Building.

McKay & Sherman, 741 Monadnock Block, Chicago, has been formed by Charles W. McKay and P. C. Sherman for the practice of engineering valuation of industrial and public utility properties.

Foreign Trade Notes

THE AMERICAN CHAMBER OF COMMERCE IN BERLIN, W-8, Equitable Building, Berlin, Germany, has established a branch office at 1939 Park Row Building, New York City, in the interests of the American manufacturer, exporter and importer. Information can be obtained on all matters pertaining to commercial intercourse between the United States and Central Europe. S. George Fremont, secretary and manager, is in charge.

TENDERS ASKED FOR ELECTRICAL AND PUMPING EQUIPMENT IN BUENOS AIRES.—The Department of Public Works of Buenos Aires, Argentina, according to the London *Electrical Times*, is asking for tenders (to be submitted by March 21) for two groups of water turbines and generators, with switchgear, etc. The Department of Sanitary Works in Buenos Aires is also inviting tenders (to be presented by March 21) for eleven sets of centrifugal pumps with electric motors and accessories.

THE SIMPLEX WIRE & CABLE COMPANY, 201 Devonshire Street, Boston, announces that it has made arrangement with the Eastern Engineering Company, with main offices in Tampico, Mexico, to handle its products in that country.

METERS REQUIRED IN MONTEVIDEO.—According to the London *Electrical Industries* the State Power House in Montevideo, Uruguay, has published tenders for the supply of 10,450 meters for private installations served by it in Montevideo, the supply comprising a three-phase, 50-cycle system. Tenders must be presented to the Secretaria del Directorio de las Usinas Electricas del Estado, Calle Dayman, No. 1471, by May 29.

ELECTRIC PLANT IN SAN SALVADOR.—The municipality of Santiago de Maria, Department of Usulutan, San Salvador, has granted a contract for the establishment of an electric light company which is to supply electricity in that city and also to the city of Berlin, in the same department. The population of the two cities is estimated at 10,000 and 9,000 respectively.

HYDRO-ELECTRIC DEVELOPMENT IN FORMOSA.—The general government of Taiwan, according to Consul Dooman, is now considering the advisability of sanctioning the erection by the Asano interests of a hydro-electric power plant to develop 100,000 hp. on the upper reaches of the Tiako River, in the south of Formosa. The Asano interests are promoting the project, assisted by American capital and American engineers, and the machinery is to be purchased in the United States.

DEMAND FOR ELECTRICAL EQUIPMENT AND MACHINERY IN SPAIN.—At present there is a good market for electrical appliances and machinery in Spain. Large power plants are now being built, especially in the provinces of Barcelona and Granada. Plants developing more than 750,000 hp. have been constructed lately.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A mercantile distributing company in Canada (No. 34,442) desires to secure an agency for the sale of electrical specialties, etc.

New Apparatus and Publications

TOOLS.—The Goodell-Pratt Company, Greenfield, Mass., is distributing its "No. 14 Tool Book," in which it describes and illustrates over 2,000 sizes and kinds of tools for toolmakers, machinists, carpenters and householders.

TRANSFORMERS.—The Pittsburgh Transformer Company, Pittsburgh, has issued bulletin No. 2010, covering its "Pittsburgh" distributing transformers.

STORAGE BATTERIES.—The Gould Storage Battery Company, 30 East Forty-second Street, New York City, has issued bulletin L-2, describing types L-149-A and L-149-B of Gould storage batteries for mining and industrial locomotives. Catalog V-7 covers its electric vehicle types of storage batteries with "Dreadnaught" plates. The company is also distributing three booklets giving instructions on the care and operation of the Gould locomotive batteries, Gould batteries in mine locomotives and Gould batteries in starting and lighting systems respectively.

PROTECTIVE APPARATUS.—The Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, has issued bulletin No. 175, covering the Graton-Daniels and Keystone lightning protective apparatus.

INSULATORS AND LINE MATERIAL.—The Ohio Brass Company, Mansfield, Ohio, is distributing its 1921 catalog, No. 18. The book is cloth-bound and contains 638 pages.

BOILER PLANT ECONOMY.—The H-S-B-W Cochrane Corporation, Philadelphia, has issued a second revised edition of "Finding and Stopping Waste in Modern Boiler Rooms." The book is cloth bound and contains 414 pages.

ELECTRIC BOTTLE WASHER.—The Electric Specialty Company, Stamford, Conn., is distributing bulletin No. 227, covering the "ESCO" electric bottle washer and general household motor combined in one unit.

DIESEL ENGINES.—The Busch-Sulzer Brothers Diesel Engine Company, St. Louis, is distributing a bulletin describing its Diesel engines in large hydro-electric, stand-by and auxiliary plants.

CONNECTOR PLUG.—The Ideal Electric Manufacturing Company, 42 Walnut Street, N. J., is distributing a four-page leaflet describing its "Attachall" plug for irons, toasters, stoves, percolators and other heating apparatus.

ELECTRIC BUFFER.—The U. S. Electrical Manufacturing Company, Los Angeles, has recently developed a new heavy-duty Johnson electric buffer.

ELECTRIC MOTIVE POWER.—"Industrial Electricity" is the title of a booklet published by the Habirshaw Electric Cable Company, Yonkers, N. Y., which gives practical suggestions and data for the manufacturer regarding the use of electricity in industrial plants.

New Companies

CARNAHAN & DALZELL, INC., New York, has been incorporated by R. O. Carnahan, B. Gunn and R. N. Dalzell, Great Kills, S. I. The company is capitalized at $20,000 and proposes to manufacture electrical machinery.

THE LIGHTHOUSE CORPORATION, New York, has been incorporated by I. L. and B. Newland, 468 West Broadway, to manufacture brass and other metal lighting fixtures. The capitalization is $50,000.

HUNTER BROTHERS, INC., Elizabeth, N. J., has been incorporated by Joseph B., Richard J. and James F. Hunter, 334 Morris Avenue. The company is capitalized at $50,000 and proposes to manufacture electrical appliances.

THE ANGLE LAMP COMPANY, New York, has been incorporated by B. L. Hewitt, L. Whitcomb and W. V. McMahon, 110 West Fortieth Street, to manufacture electric lamps, fixtures, etc. The company is capitalized at $55,000.

THE MOTOR DRIVEN CLOCK CORPORATION, New York, has been incorporated by P. F. Casey, C. W. Landers and I. S. Lambert, 132 Nassau Street, with a capital stock of $50,000. The company proposes to manufacture electrically operated clock mechanisms, parts, etc.

THE NATIONAL ELECTRIC FIXTURE COMPANY, 15-17 South Clinton Street, Chicago, has been incorporated by William C. Duncan, Bernard M. Smith and William F. Higgins. The company is capitalized at $25,000 and proposes to manufacture electrical specialties.

THE WESTON BATTERY COMPANY, New Haven, Conn., has been incorporated by F. P. Hauser, Ansonia; J. H. Benedict, Westport; F. L. Barnes, Harry Weston, Jr., and others. The company is capitalized at $100,000 and proposes to manufacture electrical supplies.

THE R. B. N. ROTARY MOTORS CORPORATION, Grantwood, N. J., has been incorporated by William R. Krebs, P. E. Brulatour, E. W. Norton and others. The company is capitalized at $125,000 and proposes to manufacture motors and parts.

THE ILLUMINATING MANUFACTURING CORPORATION, Chicago, Ill., has been incorporated by James R. Hughes, 15 South Clinton Street; W. C. Duncan, Jacob Ahren and others. The company is capitalized at $25,000 and proposes to manufacture lighting fixtures.

THE BARABOO MANUFACTURING COMPANY, Baraboo, Wis., has been incorporated by Ferdinand Effinger, W. M. Ott, George W. Andrews and others. The company is capitalized at $100,000 and proposes to manufacture electrically operated refrigerating units for domestic and commercial use.

Record of Electrical Patents

Notes on United States Patents

(Issued Feb. 8, 1921)

1,367,842. ELECTRIC FURNACE FOR TREATING GASES; Bruno Thomas, Seattle, Wash. App. filed April 30, 1917. Fixation of atmospheric nitrogen.

1,367,844. LAMP-VOLTAGE REGULATOR; William A. Turbayne, Niagara Falls, N. Y. App. filed July 18, 1917. Car-lighting system.

1,367,845. LAMP-VOLTAGE REGULATOR; William A. Turbayne, Niagara Falls, N. Y. App. filed July 23, 1917. Car-lighting system.

1,367,913. TROLLEY WHEEL; Raymond G. Larson, Owatonna, Minn. App. filed May 26, 1920. Spiral replacing grooves.

1,367,915. ELECTROMAGNETIC APPARATUS; Marius C. A. Latour, Paris, France. App. filed Aug. 2, 1917. For submarine telegraphy or telephony.

1,367,920. TROLLEY SHOE; Joseph S. O'Brien, Westfield, Mass. App. filed July 3, 1920. Non-rotary.

1,367,949. THERMIC TELEPHONE; Pieter de Lance and Robert Aernout, Baron van Lynden, Utrecht, Netherlands. App. filed Nov. 4, 1915. Carried upon the person.

1,367,953. HEATER; Edwin L. Emerson, Braintree, Mass. App. filed Nov. 15, 1919. For heating tools used in manufacture of shoes.

1,367,957. TRANSFORMER; Harry O. Garretson, New York, N. Y. App. filed May 28, 1918. X-ray..

1,367,967. TELEPHONE-EXCHANGE SYSTEM; George H. Heydt, New York, N. Y. App. filed March 21, 1917. Automatic.

1,367,982. MOTOR; Gustave Lidseen, Chicago, Ill. App. filed July 3, 1917. Toothed armature without windings.

1,367,988. SPARK COIL AND METHOD OF MAKING SAME; James B. Replogle, Detroit, Mich. App. filed Nov. 25, 1916. Amount of winding materially reduced.

1,368,006. TROLLEY WHEEL; Stanley Zelazo, Adams, Mass. App. filed Oct. 29, 1919. Two-wheel construction.

1,368,010. ELECTROLYTIC CELL; Herbert I. Allen, Portland, Me. App. filed April 29, 1920. Production of chlorine and caustic soda.

1,368,011. ELECTROLYTIC CELL; Herbert I. Allen, Portland, Me. App. filed April 29, 1920. Greater active surface secured.

1,368,019. PROCESS FOR FIXATION OF NITRATES; Charles H. Buettner, Cincinnati, Ohio. App. filed March 6, 1919. Simple commercial process.

1,368,062. RADIANT ELECTRIC HEATER; Milton H. Shoenberg and George J. Henry, San Francisco, Cal. App. filed Oct. 16, 1919. May be laterally oscillated.

1,368,083. GROUND CLAMP; Philip Windman, Perth Amboy, N. J. App. filed Jan. 20, 1920. Connects to pipe.

1,368,092. RECORDING INSTRUMENT; Oliver T. Alexander, Altonpark, Tenn. App. filed Oct. 4, 1919. For electric pushing and leveling machines of by-product coke ovens.

1,368,093. SEPARATOR FOR STORAGE-BATTERY PLATES; James M. Allen, St. Louis, Mo. App. filed Feb. 24, 1920. Resilient ribs on each side.

1,368,094. PROTECTING DEVICE AGAINST X-RAYS AND SIMILAR RADIATIONS; Pierre A. M. J. Angebaud, Nantes, France. App. filed Sept. 28, 1917. Silicate of potassium or sodium.

1,368,108. GUARD FOR HEATERS; Edmund N. Brown and Milton H. Shoenberg, San Francisco, Cal. App. filed Oct. 1, 1919. Easily detachable.

1,368,152. ELECTRICALLY HEATED CULINARY UTENSIL; William D. Huff, Lafayette, La. App. filed July 3, 1919. Used in kitchens, pantries, etc.

1,368,206. LARGE-CAPACITY CELL FOR GENERATING HYDROGEN AND OXYGEN; John B. Burdett, Glencoe, Ill. App. filed Sept. 27, 1920.

1,368,212. ELECTRIC STEAM GENERATOR; Francesco Revel, Turin, Italy. App. filed July 8, 1918. Water-resistance type.

1,368,224. RANGE INDICATOR; Elmer Meitner, Brooklyn, N. Y. App. filed June 13, 1915. Indicates range of distant object.

1,368,227. OSMOTIC DIAPHRAGM; Elmer A. Sperry, Brooklyn, N. Y. App. filed Dec. 26, 1918. Manufacturing white lead, or other lead salts, by electrolysis.

(Issued Feb. 15, 1921)

15,040 (reissue). AËRIAL CONDUCTOR FOR WIRELESS TELEGRAPH; Charles S. Franklin, London, England. App. filed Nov. 18, 1919. In conjunction with transmitting station for duplex telegraphy.

15,041 (reissue). AËRIAL CONDUCTOR FOR WIRELESS TELEGRAPHY; Charles S. Franklin, London, England. App. filed Nov. 18, 1919. In conjunction with transmitting station for duplex telegraphy.

15,043 (reissue). ELECTRICAL ATTACHMENT PLUG; Johann G. Peterson, Hartford, Conn. App. filed Sept. 17, 1918. Socket plug.

1,368,261. TRANSMITTER MOUNTING; George M. O. Jenkins, Paris, France. App. filed Nov. 3, 1917. For aviator.

1,368,265. ELECTRIC HEATER; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed April 16, 1919. Luminous.

1,368,287. ARC-WELDING ELECTRODE; Harry R. Pennington and Ernest Wanamaker, Chicago, Ill. App. filed June 23, 1920. Distinguishing color for each electrode of given composition.

1,368,288. ELECTROMAGNETIC DEVICE; Ralph E. Pierce, Larchmont, N. Y. App. filed Dec. 13, 1918. Balanced relays.

1,368,307. EARPIECE; Fred D. Waldron, Brooklyn, N. Y. App. filed April 13, 1918. Telephone receivers.

1,368,323. ELECTRIC CONTROLLING DEVICE; Rudolph Contrader, Erie, Pa. App. filed Sept. 7, 1916. Pressure-actuated motor controls rheostat.

1,368,325. ARC-EXTINGUISHING DEVICE; Leslie N. Crichton, Wilkinsburg, Pa. App. filed Aug. 30, 1916. Does not disturb the operation of apparatus connected.

1,368,328. ELECTRIC HEATING DEVICE; Richard M. Eaton, Niagara Falls, N. Y. App. filed Oct. 6, 1920. Fan and heater.

1,368,336. ELECTROMAGNETIC BRAKE; Max E. Gysel, Wilkinsburg, Pa. App. filed June 13, 1917. For hoists.

1,368,339. MEANS FOR PROTECTING TRANSMISSION LINES; Ray P. Jackson, Edgewood Park, Pa. App. filed June 19, 1915. Abnormal potentials, resulting from reactance of line, precluded.

1,368,343. SUMMATING DEVICE; Walter E. McCoy, New York, N. Y. App. filed March 25, 1916. To combine plurality of forces into single resultant.

1,368,345. ELECTROMAGNETIC BRAKE; Chester B. Mills, East McKeesport, Pa. App. filed March 1, 1917. For hoisting apparatus.

1,368,350. COIL-SUPPORTING DEVICE; Raoul Prugger, Irwin, Pa. App. filed July 28, 1917. For supporting end turns.

1,368,360. TROLLEY EAR; William H. Siemon and Harry L. Garbutt, Wilkinsburg, Pa. App. filed Dec. 14, 1918. Pressed metal.

1,368,362. MACHINE FOR ELECTROCYANIDE CHLORINATION PROCESS; Rush T. Sill, Los Angeles, Cal. App. filed April 6, 1919. Pulp submitted to action of a cyanide solution in presence of an electrical current.

1,368,369. MOTOR-CONTROL SYSTEM; Wilfred Sykes, Pittsburgh, Pa. App. filed Dec. 14, 1915. Used in connection with saws, etc.

1,368,376. RELAY INTERRUPTER; Richard I. Utter, Oak Park, Ill. App. filed March 24, 1917. Telephone.

1,368,404. ELECTRIC OIL AND GAS PRODUCER; Nicholas R. Loftus, Beckley, W. Va. App. filed Nov. 25, 1919. Lowered in played-out well and heated.

1,368,412. ELECTRICAL HEATING PAD; Even J. Rohne, Minneapolis, Minn. App. filed Feb. 11, 1920. Flexible.

1,368,462. SYSTEM OF ELECTRICAL CONTROL; Charles F. Smith, Cle Elum, Wash. App. filed May 15, 1917. Mining.

1,368,479. PROCESS FOR PRESERVING DRY BATTERIES; Walter S. Brown, Seattle, Wash. App. filed June 11, 1919. Preservative coating.

1,368,481. TELEPHONE-ANSWERING INSTRUMENT; Warren D. Calvert, Altoona, Pa. App. filed Feb. 20, 1919. Phonograph answers telephone.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

HARTFORD, CONN. — The Hartford Electric Light Company has petitioned the State Legislature for authority to increase its capital stock to $20,000,000.

HARTFORD, CONN.—The Lincoln Dairy Company, 52 Lincoln Street, contemplates the construction of a power house in connection with its new dairy.

NEW MILFORD, CONN.—The New Milford Electric Light Company has petitioned the State Legislature for authority to increase the capital stock of the company to $200,000.

WATERBURY, CONN. — The Seoville Manufacturing Company, Bridge Street, contemplates the installation of electrical equipment in its proposed brass mill to cost about $100,000.

Middle Atlantic States

BUFFALO, N. Y.—Plans are under consideration to replace all gas street lamps with electric lamps.

BUFFALO, N. Y.—The Niagara, Lockport & Ontario Power Company, Marine Bank Building, has applied to the Federal Power Commission for permission to construct a hydro-electric power plant on the Niagara River below the falls.

CAMPBELL, N. Y.—Preliminary plans are under way for the construction of a hydro-electric power plant in the vicinity of Campbell. J. R. Pulsifer, 60 South Clinton Street, Rochester, is interested. W. S. Lozie, Cutler Building, Rochester, is electrical engineer.

HEMPSTEAD, N. Y.—The Village Board is considering submitting to the voters at the coming election the proposal to issue bonds to establish a municipal electric light plant.

LONG BEACH, N. Y.—Plans have been completed by the Long Beach Power Company, Park Street, for the construction of an addition to its power plant, to cost about $125,000, including equipment.

LONG ISLAND CITY, N. Y.—The Astoria Light & Power Company, 130 East Fifteenth Street, New York City, contemplates the construction of an addition to its plant to cost about $80,000.

NEW YORK, N. Y.—The New York Central Railroad Company, Grand Central Terminal, has had plans prepared for the construction of an electric substation at Park Avenue and 110th Street to cost about $22,000.

NEW YORK, N. Y.—The White Fuel Oil Engineering Company, 742 East Twelfth Street, plans to install electrical equipment in the foundry, 100 ft. x 103 ft., to be built at 732 East Twelfth Street, estimated to cost about $75,000.

NIAGARA FALLS, N. Y.—The Federal Power Commission has granted the Niagara Falls Power Company a fifty-year license to use 19,500 cu.ft. of water a second from the Niagara River above the falls. Under the permit the company must hasten the extensive improvements and enlargements of its plants and erect a new transmission line across Grand Island to Buffalo and also another line to supply energy to the Niagara, Lockport & Ontario Company, which now purchases its power from Canada under one-year contracts. The additions required by the company will increase the output of the company's plant from 300,000 hp. to 400,000 hp.

TROY, N. Y.—The Federal Power Commission has granted Henry Ford, Detroit, permission to utilize water from the government dam at Troy for power development purposes in connection with a factory project involving an expenditure of $7,500,000. The cost of the power development is estimated at $2,500,000.

HANOVER, N. J.—The Hanover Township Committee is planning for the establishment of a new lighting district to include Hanover, Hanover Neck and vicinity. An initial installation of about 142 lamps will be made.

METUCHEN, N. J.—The General Ceramics Company, 50 Church Street, New York City, contemplates the installation of considerable electrical and mechanical equipment in the proposed addition to its local plant. The new building, including equipment, will cost about $400,000.

NEWARK, N. J.—The Board of Freeholders of the Overbrook Hospital, near Caldwell, contemplates the installation of electrical and mechanical equipment in the proposed industrial school.

TRENTON, N. J.—The City Commission has plans under way for the installation of a new street-lighting system in South Montgomery Street to include a underground conduit system. Prof. C. E. Clewell is consulting engineer for city street lighting.

DOYLESTOWN, PA.—The Bucks County Chamber of Commerce, recently organized, has tentative plans under way for the utilization of water from the Delaware River in this vicinity for power purposes. Plans include the establishment of a hydro-electric power plant for service in different sections of the county. T. B. Stockham, Morrisville, is president.

HARRISBURG, PA. — Ordinances have been approved by the City Council providing for the purchase of equipment for the installation of new underground conduit system in Walnut and Susquehanna Streets and new street lamps in Fifteenth Ward.

HUMMELSTOWN, PA.—Plans are under way by the Hummelstown Water & Power Company for the construction of an electrically operated filtration plant to cost about $35,000.

PHILADELPHIA, PA. — Considerable electrical equipment will be installed in a group of proposed two-story buildings to be built by the Anna T. Jeanes Memorial Hospital. Heacock & Homanson, Bailey Building, are architects.

PHILADELPHIA, PA. — J. D. Cassell, superintendent of school buildings, has recommended that the sum of $700,000 be appropriated for the installation of electric lighting in the various schools.

PHILADELPHIA, PA.—A bill has been presented to the State Legislature asking an appropriation of $350,000 for power plant for the Jewish Hospital.

PITTSBURGH, PA.—The West Power Company, West Penn Building, has tentative plans under way for the construction of a third generating unit, about 200 ft. x 900 ft., at its electric power plant at Springdale, estimated to cost, with machinery, $5,000,000.

BALTIMORE, MD.—Tentative plans are under way by the Consolidated Gas, Electric Light & Power Company, it is reported, for the construction of a large electric power plant at St. Helena. The proposed plant would be built on the unit system, and when completed would be considerably larger than the Westport plant, which has a capacity of from 140,000 kw. to 160,000 kw. The cost of the project has been estimated at $40,000,000.

BERWYN HEIGHTS, MD.—Negotiations are under way between the Berwyn Heights Association and the local electric light and power company for the installation of an electric system throughout this section. C. Stein is chairman of the light committee.

WESTMINSTER, MD.—The construction of a power plant is contemplated in connection with a group of new buildings being planned by the Board of Trustees of the West Maryland College. The cost of the entire project is estimated at $1,000,000.

FAIRMONT, W. VA.—The installation of electrical and mechanical equipment at its properties in Fairmont is contemplated by the Fort Grand Coal Company, Morgantown, recently organized with a capital stock of $80,000. W. T. Hughes is president and manager.

WILLIAMSON, W. VA. — The Coalton Coal Corporation, recently organized, plans to install electrical and mining equipment, etc., at its properties near Williamson. J. T. Jones, Cambria, Va., is secretary-treasurer.

WASHINGTON, D. C.—Complete development of the Potomac River, with dams at Great Falls and Chain Bridge, for water power and water supply purposes, has been recommended by the Federal Power Commission to Congress, and authority to start work immediately is sought. Major M. C. Tyler of the Engineer Corps of the United States Army is in charge.

North Central States

MARLETTE, MICH.—Plans, it is reported, have been prepared for the construction of an electric light plant and water works in Marlette. Clarence Hubbell, 2338 Penobscot Building, Detroit, is engineer.

KENDALLVILLE, IND.—A bond issue of $70,000 has been approved by the City Council for improvements to the municipal electric power plant, including the installation of equipment.

CHAMPAIGN, ILL.—The installation of a lighting system in the business district from the Big Four tracks to Green Street and from Second to Randolph Streets is under consideration. The cost is estimated at $153,000.

CHICAGO, ILL. — The Public Service Company of Northern Illinois has applied to the Public Utilities Commission for authority to issue $2,000,000 in bonds, the proceeds to be used for improvement of service.

CHICAGO, ILL.—Changes to the lighting system on Michigan Avenue between Pearson Street and Oak Street will be made necessary in connection with plans of the Lincoln Park Commissioners to widen that section of Michigan Avenue.

MILWAUKEE, WIS. — The Milwaukee Electric Railway & Light Company contemplates the construction of a second unit at its electric generating plant.

MILWAUKEE, WIS.—The installation of an electric lighting system in Kosciusko and Juneau Parks, similar to the one recently installed in Washington, is under consideration.

RACINE, WIS.—The plant of the Wisconsin Gas & Electric Company, it is reported, was recently damaged by fire, causing a loss of about $50,000.

OKANOGAN VALLEY (WASH.) POWER COMPANY PLANT

Construction of this 5,500-hp. plant on the Similkameen River has just been completed. The initial unit of 2,500 hp. is expected to suffice for two or three years.

RIVER FALLS, WIS.—Plans are under consideration by the Board of Normal Regents, Madison, for the construction of a power house, 50 x 85 ft., at the Institution at River Falls. The cost is estimated at about $25,000.

MINNEAPOLIS, MINN.—Improvements to the street-lighting in Minneapolis are under consideration, including extension of the ornamental system and the substitution of all gas lamps for electric lighting. The city has $340,000 available for carrying out the 1921 lighting program, which calls for the installation of 340 new arc lamps in various wards before July 1. G. H. Rentz is chairman of the lighting committee.

FULTON, MO.—At an election to be held in April the proposal to issue bonds to the amount of $75,000 for improvements to the light and water plants will be submitted to the voters.

INDEPENDENCE, MO.—Plans have been prepared for the construction of an electric lighting plant for the city. Black & Veatch, 701 Mutual Building, Kansas City, are engineers.

WORTHING, S. D.—The local electric light plant, it is reported, was recently damaged by fire.

LINCOLN, NEB.—Plans are under consideration for the establishment of a police signal station system for protection for outlying districts. City Commissioner J. D. Ringer is head of the police department.

TOPEKA, KAN.—Improvements in connection with the state penitentiary, including the construction of a new power plant to cost $125,000 and the installation of electrical equipment for the operation of coal mines, to require an equal amount, are named in an appropriation bill prepared by the ways and means committee of the Senate.

Southern States

WAYNESVILLE, N. C.—Plans are under way by engineers of the Natural Abrasive Mining Company of America, recently organized with a capital stock of $2,000,000, for extensive mining developments in the vicinity of Waynesville. The plans include the construction of hydro-electric plants.

CORDELE, GA. — The City Council is considering the construction of a light and power plant in connection with the municipal water plant to cost about $40,000. W. G. Webb is engineer.

JEFFERSONVILLE, GA.—The installation of a lighting plant for school building in Jeffersonville is under consideration. Happ & Shelverton, Macon, are architects.

LYONS, GA.—The Council is considering the construction of a dam across Pendleton Creek, to generate electricity for lighting and commercial purposes. The cost of the project is estimated at $1,000,000.

FORT PIERCE, FLA.—At an election to be held on March 15 the proposal to issue bonds to the amount of $60,000 for improvements to the electric light and power plant will be submitted to the voters.

ANDALUSIA, ALA. — The Andalusia Light & Power Company contemplates the installation of a turbo-generator with auxiliary equipment at its power plant.

MONTGOMERY, ALA.—A survey of the city is being made by H. A. Washington, city engineer, with a view of replacing many of the arc lamps now in use with incandescent lamps. The street lighting service is furnished by the Montgomery Light & Water Company.

WARREN, ARK.—The installation of an electric lighting plant for dormitory at the Walters Institute is under consideration. J. W. Eichelberger, Jr., is president.

ALEXANDRIA, LA.—The Gravity Canal Company is considering the construction of a hydro-electric plant in the Bayou Cocodrie district.

HOUMA, LA.—At an election to be held March 15 the proposal to issue bonds to the amount of $180,000 for the construction of a combined light, waterworks and filtration plant will be submitted to the voters.

BROKEN BOW, OKLA.—Improvements to cost about $50,000 to the municipal electric light plant are under consideration.

Pacific and Mountain States

ENTERPRISE, ORE. — The Enterprise Electric Company contemplates the construction of a power plant and an initial installation of a 1,000-hp. unit. The cost of the plant is estimated at $100,000.

ALTA LOMA, CAL.—The operation of the local pumping station by electricity is under consideration.

DENVER, COL.—J. E. Myser and E. E. Drach, 1133 Clarkson Street, have applied to the Federal Power Commission for permission to construct a series of nine small diversion dams and pipe lines leading to a succession of five power houses on the Frying Pan River.

Miscellaneous

GUANAJUATO, MEXICO.—The Guanajuato Light & Power Company, it is reported, contemplates important improvements and additions. Plans include increasing the capacity of its hydro-electric plants and extending its power transmission lines to various mining districts and industrial centers. The company's lines now extend throughout the states of Guanajuato and Jalisco.

MONTEREY, MEXICO. — The Dolores Mines Company, an American corporation, plans to construct a large electric power plant at Madera, State of Chihuahua, and an ore reduction mill at Dolores, in the same state. The company owns and operates gold and silver mines in the Guerrero district of Chihuahua. The cost is approximated at $750,000.

PANAMA.—Bids will be received by A. L. Flint, General Purchasing Officer of the Panama Canal, Washington, D. C., until March 12 for furnishing electrical supplies and equipment, insulated wire and cable fuses, etc.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill. Annual convention, Buffalo, N. Y., May 10.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa. Annual meeting, Atlantic City, N. J., April 21-23.

AMERICAN ENGINEERING STANDARDS COMMITTEE. Secretary, P. G. Agnew, 29 W. 39th St., New York City.

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ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City. Annual meeting, New York City, March 15.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, Electrical Testing Laboratories, New York.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

ASSOCIATION OF MUNICIPAL ELECTRICAL UTILITIES OF ONTARIO. Secretary, S. R. A. Clement, 190 University Ave., Toronto. Annual convention, Toronto, June 28.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill.

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ELECTRICAL MANUFACTURERS' COUNCIL. Executive secretary, Frederic Nicholas, 522 5th Ave., New York City.

ELECTRICAL SAFETY COUNCIL. Secretary, Dana Pierce, 25 City Hall Place, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbaugh, 411 South Clinton St., Chicago, Ill.

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ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADE ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

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Printed in the First Issue of Each Month

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ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

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NATIONAL COUNCIL OF LIGHTING FIXTURE MANUFACTURERS. Secretary, C. W. Hoffrichter, 8410 Lake Ave., Cleveland, Ohio.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass.

NATIONAL ASSOCIATION OF RAILWAY AND UTILITY COMMISSIONERS. Secretary, James B. Walker, Public Service Commission of the State of New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City. Annual convention, Chicago, May 31-June 3.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

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NORTH CENTRAL GEOGRAPHIC DIVISION, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis. Annual convention, Duluth, Minn., June 14-16.

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OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

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OKLAHOMA UTILITIES ASSOCIATION. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City. Annual meeting, Oklahoma City, March 8, 9 and 10.

PACIFIC COAST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, S. H. Taylor, Electric Railway & Manufacturers' Supply Co., San Francisco, Cal. Annual meeting, Del Monte, Cal., May 25, 26 and 27.

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SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 721 First National Bank Building, El Paso, Tex.

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